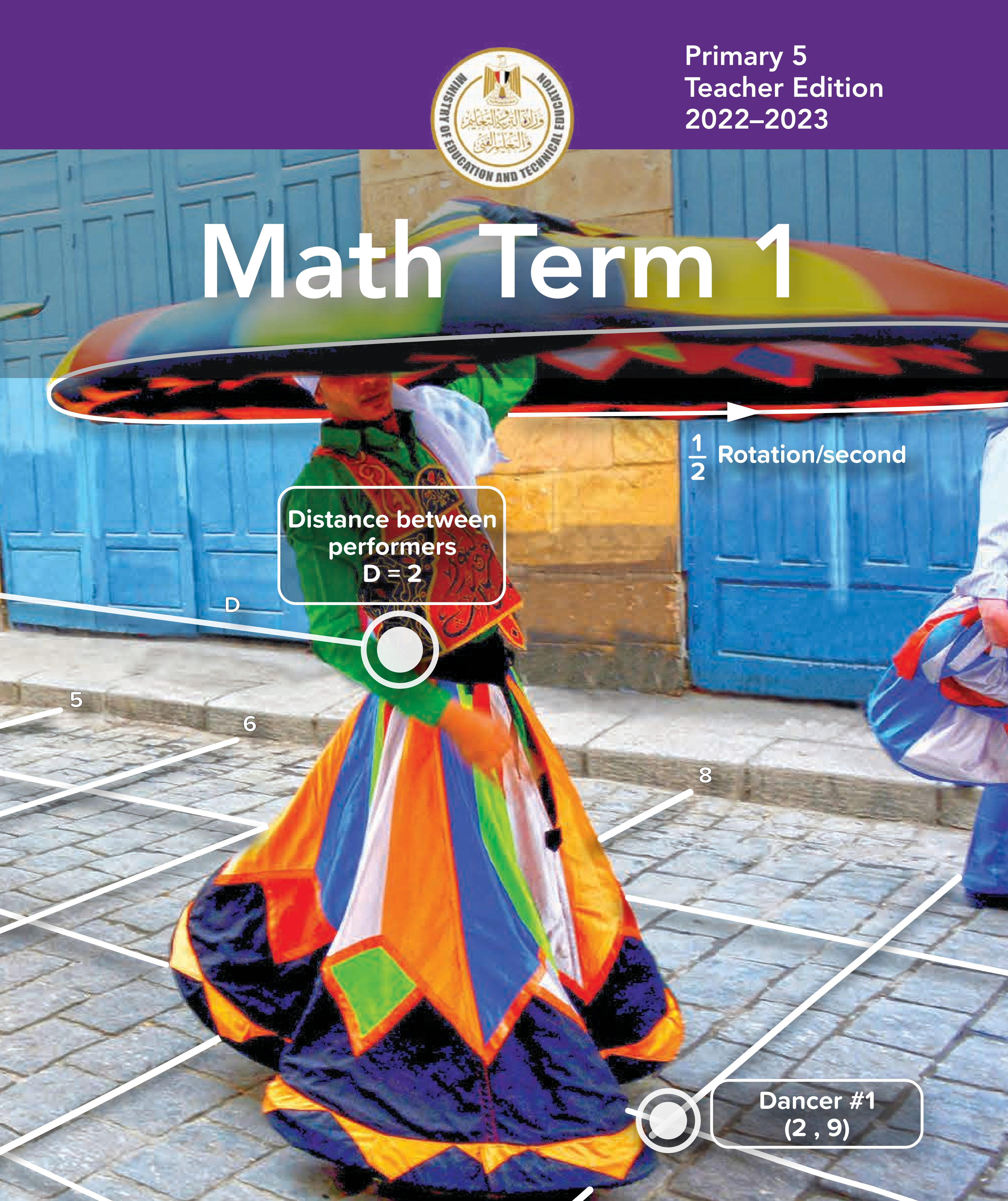
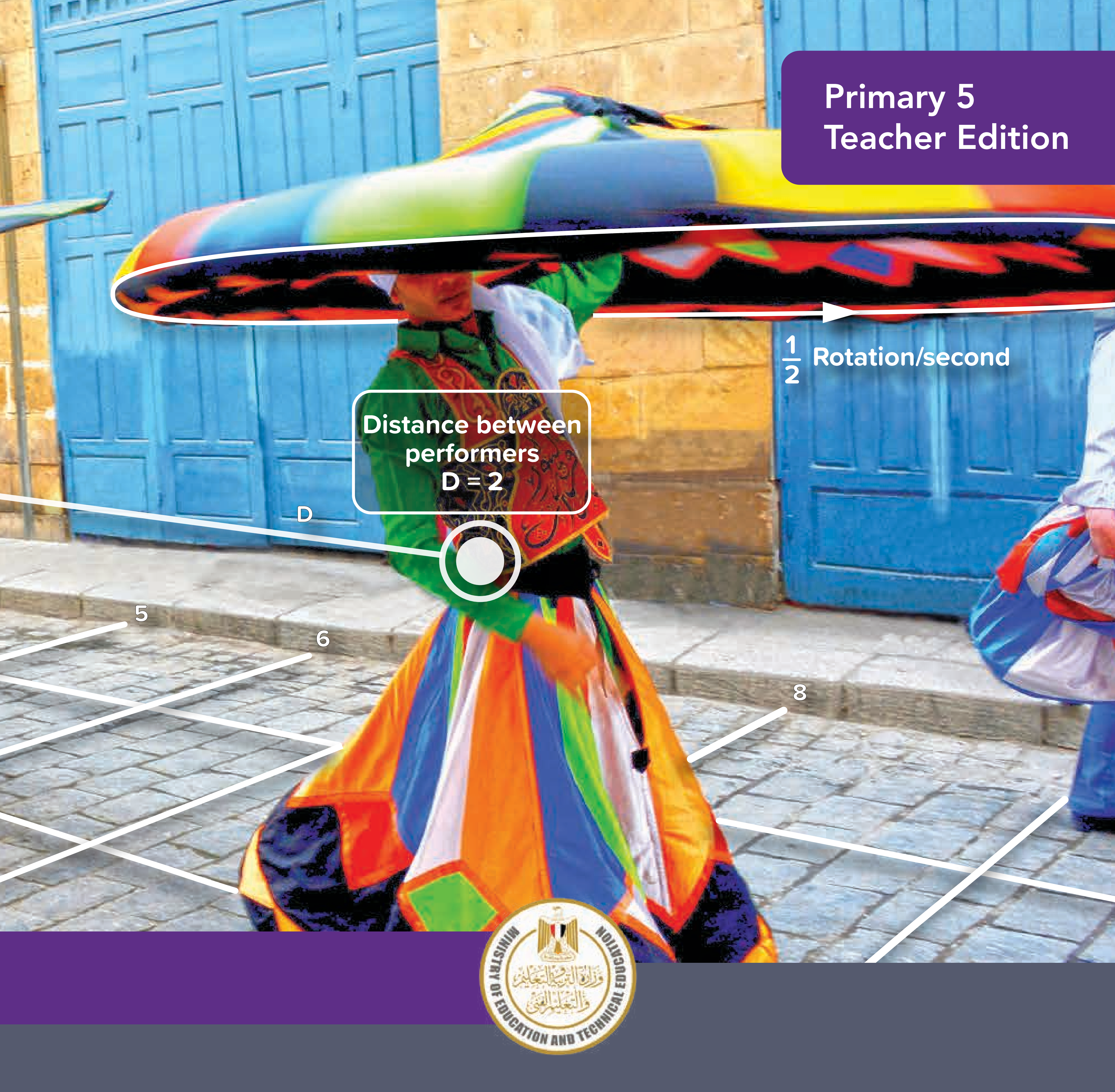

Primary 5
Teacher Edition
2022–2023
MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
Math Term 1
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Distance between performers
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Dancer #1
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Primary 5
Teacher Edition
$\frac{1}{2}$ Rotation/second
Distance between performers
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MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
وزارة التربية والتعليم والتعليم الفني

Math Term 1

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FOREWORD

This is a pivotal time in the history of the Ministry of Education and Technical Education (MOETE) in Egypt. We are embarking on the transformation of Egypt's K-12 education system. We started in September 2018 with the rollout of KG1, KG2, and Primary 1. In 2021 we rolled out Primary 4, and we will continue with the rollout until 2030. We are transforming the way in which students learn to prepare Egypt's youth to succeed in a future world that we cannot entirely imagine.

MOETE is very proud to present this new series of textbooks, with the accompanying digital learning materials that captures its vision of the transformation journey. This is the result of much consultation, much thought and a lot of work. We have drawn on the best expertise and experience from national and international organizations and education professionals to support us in translating our vision into an innovative national curriculum framework and exciting and inspiring print and digital learning materials.

The MOETE extends its deep appreciation to its own "Center for Curriculum and Instructional Materials Development" (CCIMD) and specifically, the CCIMD Director and her amazing team. MOETE is also very grateful to the minister's senior advisors and to our partners including "Discovery Education," "National Geographic Learning" "Nahdet Masr," "Longman Egypt," UNICEF, UNESCO, and WB, who, collectively, supported the development of Egypt's national curriculum framework. I also thank the Egyptian Faculty of Education professors who participated in reviewing the national curriculum framework. Finally, I thank each and every MOETE administrator in all MOETE sectors as well as the MOETE subject counselors who participated in the process.

This transformation of Egypt's education system would not have been possible without the significant support of Egypt's current president, His Excellency President Abdel Fattah el-Sisi. Overhauling the education system is part of the president's vision of 'rebuilding the Egyptian citizen' and it is closely coordinated with the ministries of Higher Education & Scientific Research, Culture, and Youth & Sports. Education 2.0 is only a part in a bigger national effort to propel Egypt to the ranks of developed countries and to ensure a great future to all of its citizens.

Words from the Minister of Education & Technical Education

Dear students and fellow teachers,

It gives me great pleasure to celebrate this crucial stage of comprehensive and sustainable development, an epoch in which all Egyptian people are taking part. This pivotal stage necessitates paving a foundation for a strong educational system which yields a generation that is not only capable of facing the major challenges the world is witnessing today, but one that also has complete possession of the skills of the future.

At a time when our world is witnessing successive industrial revolutions, the Egyptian state is keen on empowering its citizens by establishing a top-notch educational system that invests in its children the expertise required to get them to compete at both a regional and global level. This dictates that our educational system has at its core an emphasis on skills development, deep understanding, and knowledge production. This can only be done through modern curricula that keep up with the changes taking place globally— curricula which prioritize the development of skills and values, and the integration of knowledge. They are also curricula that focus on the provision of multiple learning sources, and integration of technology to enrich the educational process and to improve its outcomes, while addressing the most important contemporary issues.

To achieve this, we must all join hands to continue to revolutionize our education, and to support it with all that is required to transform it into a globally pioneering educational system.

My warmest regards to you, dear students, and my deepest gratitude to my fellow teachers.

Professor Reda Hegazy

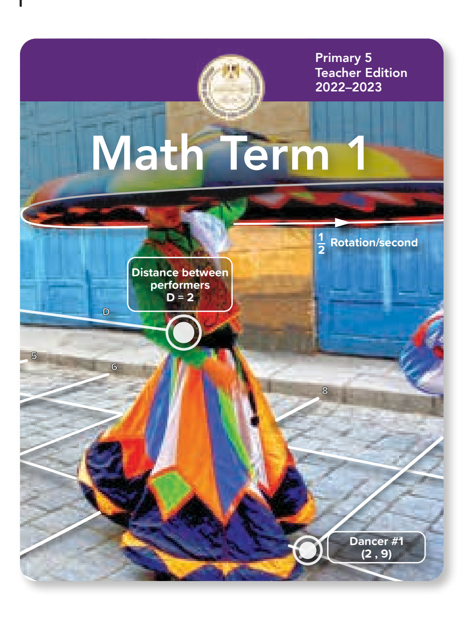
Minister of Education & Technical Education

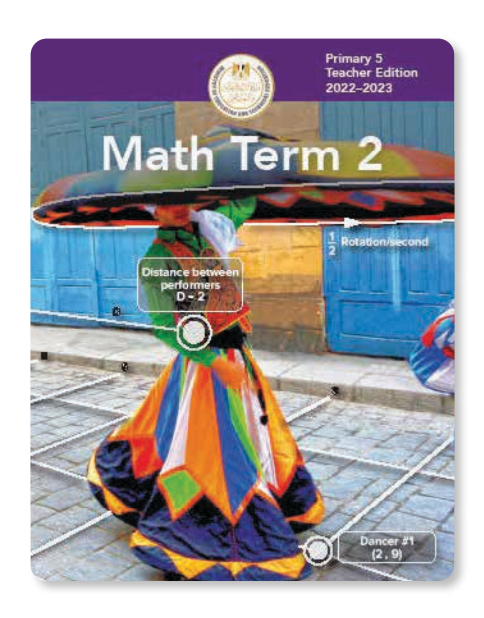


Welcome to Primary 5 Mathematics Techbook!

Mathematics is everywhere around us. Children begin investigating mathematical concepts at a very early age. In fact, researchers say babies can visually differentiate between different quantities, demonstrating budding numeracy as early as 6 months of age. Children get their first math education at home as they count, make one-to-one correspondence between ordinal numbers and objects, compare quantities, manipulate two- and three-dimensional shapes, solve puzzles, look at clocks and watches, play with money, and visit markets in their communities. Mathematics helps children make sense of the world around them. All children are capable of building deep conceptual understanding and procedural fluency in mathematics. This program seeks to support students' development as they learn to reason mathematically, communicate using appropriate mathematical language, solve complex problems, and work collaboratively with peers. As you read the new Primary 5 student and teacher instructional resources, keep a few things in mind:

- The Primary 1 through Primary 4 mathematics curriculum, implemented across Egypt starting from 2018 to 2021, helped lay a foundation for young students to solve complex mathematical problems, persevere in the face of challenging math content, and think and act like mathematicians.
- The Primary 5 mathematics content is more challenging than ever before. However, students are aided by their experience in the new KG through Primary 4 curriculum. To help all students reach the challenging expectations in Prep and Secondary, Primary 5 Mathematics Techbook offers opportunities for student to build procedural fluency, make sense of real-world problems, model their thinking and problem-solving strategies, communicate their reasoning, make connections between prior learning and new concepts, and identify patterns and rules that promote number sense and make computation more efficient.
- The Primary 5 math curriculum is called a Techbook™. The Techbook is more than just print. It is a 21st-century instructional resource designed to inspire and empower all students through digital and print learning. You will find that the program has content in both print and digital locations so that students can learn no matter what access they have to the print book or digital versions.





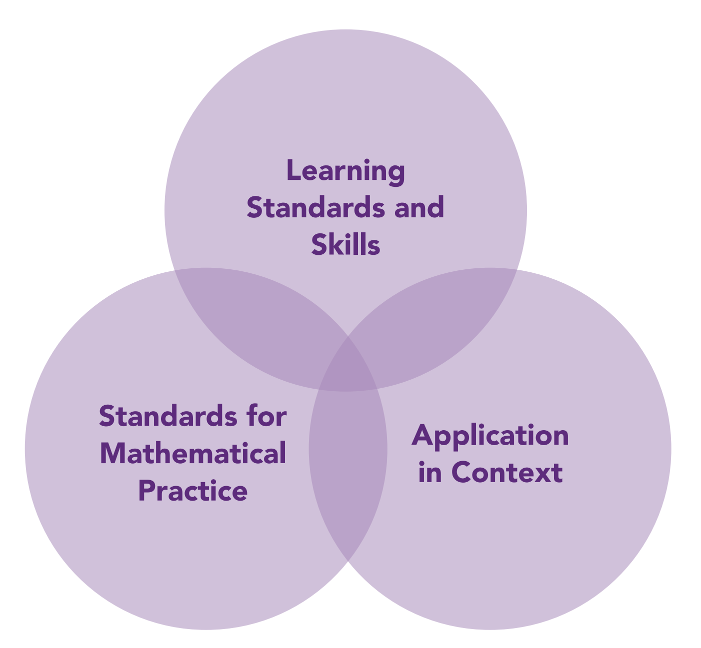
Program Philosophy

The Primary 5 Mathematics Techbook was designed and written to teach to the Ministry of Education Primary 5 Mathematics standards. These standards are internationally benchmarked, providing students in Egypt with a rigorous framework of learning targets.

The first step in building the Primary 5 standards was the adoption of new standards and specific grade-level indicators for learning and applications in number and operations, algebraic thinking, geometry, data collection and analysis, measurement, and fractions and decimals. These standards are integrated across three dimensions:

- Learning standards and skills
- Application in context
- Standards for mathematical practice

This entire approach to teaching mathematics is referred to as three-dimensional learning. The idea is that math is much more than an accumulation of facts; rather, it is an intersection of three dimensions: mathematical skills and concepts, problem solving, and engaging in practices that support mathematical thinking and reasoning.



The intersection of these three dimensions provides the foundation for the mathematics content in Primary 5. The structure of Primary 5 Mathematics Techbook also embodies the Ministry's shifts in the Framework for Education 2.0., specifically focusing on the following:

- accessing new and prior knowledge;
- building contextual understanding and procedural fluency; and
- making connections across mathematics domains to support application of skills and concepts.

Globally Prepared Students: Mathematics in Context

To help students make sense of mathematical content and to help students understand the role of mathematics in our lives, Primary 5 Mathematics Techbook integrates a thematic approach to help students understand and apply mathematics in a variety of real-world scenarios.



Engaging, Hands-On Learning: All Students as Mathematicians

Hands-On Activities (HOAs) are a central component of Primary 5 Mathematics Techbook. Hands-On Activities require students to investigate patterns and rules in mathematics; build mathematical understanding through observation, collaboration, and problem solving; communicate using mathematical language and models.

A materials list for each HOA is included in multiple locations: at front-of-concept and at point-of-use in digital, and at point-of-use in the print Teacher Edition. Mathematics materials have been chosen to be easily accessible and mostly familiar to both students and teachers. Options are given for commercially available manipulatives and paper-based versions of those manipulatives, available as Blackline Masters at the end of the Teacher Edition. Each materials list should be reviewed well in advance of the date of classroom use to ensure all materials are available or prepared.

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“Thinking Like a Mathematician”

Reading, Writing, Speaking, and Listening in Mathematics

Reading, Writing, and Mathematics

Writing is an important part of mathematics because it is how real mathematicians document and communicate their ideas, activities, and conclusions to others. Primary 5 Mathematics Techbook engages students in many kinds of writing, particularly in Writing About Math tasks, which often ask students to explain their reasoning and support their thinking using words, numbers, pictures, and symbols.

Informational texts throughout Techbook help students strengthen their reading comprehension skills while providing context for learning. Primary 5 Mathematics Techbook also expects students to use speaking and listening skills to demonstrate their understanding and application of mathematics skills and concepts. Both the digital and the print resources will engage students in the practice of this type of writing, speaking, and listening.

Building Mathematical Language of All Students

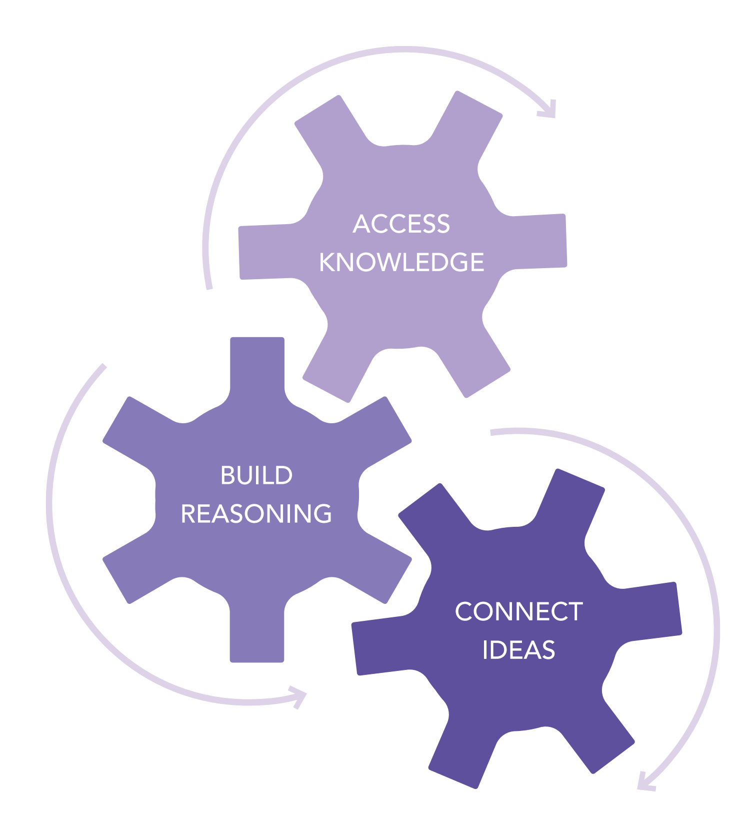
Reading and writing success in mathematics depends on the ability of students to understand not only the definition of vocabulary words, but also how the academic language connects ideas, adds details, or helps them accurately express their learning, thinking, and reasoning. Academic language is supported and emphasized through strategies for learning vocabulary, frequent vocabulary used in various contexts, and formative assessment items.

Student-Centered Learning and the A-B-C Instructional Framework

When one gear moves, they all move. All components of a lesson are dependent on one another and are not entirely linear. Students continue to access knowledge as they build understanding. They make connections as they access knowledge. They build understanding and reasoning as they connect ideas. When students engage in rich tasks that access prior knowledge and build reasoning, it is easier for them to efficiently and effectively make connections to the real world and to other mathematical learning.

A-B-C Instructional Framework

Lessons within the A-B-C Instructional framework are structured as follows:

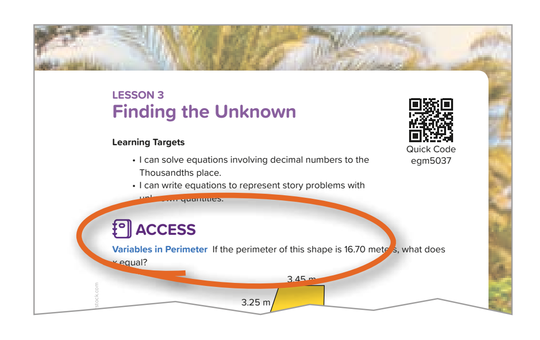


ACCESS (5–10 min)

Provides opportunities for:

- Engaging learners, leveraging prior knowledge, sparking interest
- Facilitating mathematical conversations to build connections
- Supporting various ways learners make their understandings visible

Focus: Developing and expressing mathematical language


LESSON 3
Finding the Unknown

Quick Code
egm5037

Learning Targets

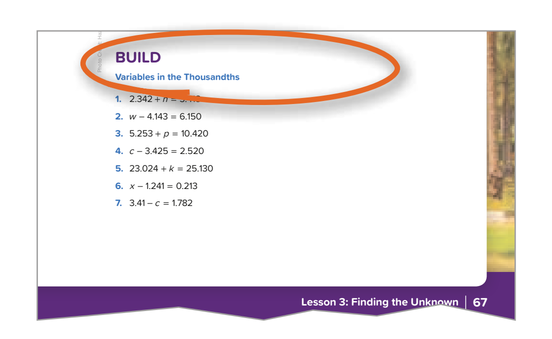
- I can solve equations involving decimal numbers to the Thousandths place.
- I can write equations to represent story problems with unknown quantities.

ACCESS

Variables in Perimeter If the perimeter of this shape is 16.70 meters, what does x equal?

3.45 m
3.25 m

BUILD (35–40 min)



Provides opportunities for:

- Developing fluencies with graduated levels of support
- Questioning, responding, and giving suggestions to support learning
- Reflecting on mistakes and misconceptions to improve understanding

Focus: Communicating about understanding, reasoning, evidence, strategies, and lingering questions

CONNECT (5–7 min)



Provides opportunities for:

- Connecting learner-generated strategies to procedures
- Engaging in challenging tasks that allow learners to transfer knowledge to new situations
- Identifying, expressing, and applying critical connections between and among mathematical skills and concepts

Focus: Building ability to communicate deep conceptual understanding and to ask meaningful questions to challenge misconceptions

WRAP-UP (3–5 min)

- Students express verbally or in writing what they "connected" and learned.

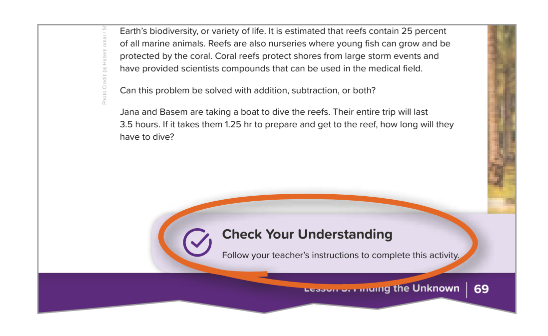
PRACTICE

- Helps teachers make decisions about instructional grouping and differentiation
- Varied practice problems that allow students to demonstrate learning

Flexible use:

- Could be done with whole group, in small groups with or without the teacher, or independently (at the teacher's discretion)
- Could be part of remediation
- Could be an extension of the Wrap-Up discussion
- Lives in the digital Student Edition

Check Your Understanding



- All lessons include a Check Your Understanding (CYU) section that consists of 3–5 practice problems. These problems allow teachers to collect information quickly and effectively about students' learning.
- The section can be assigned for independent practice during small group instruction (while the teacher works with other students) or homework.
- The section can include a little spiral review, but that should not be the focus of the CYU.
- These can be used for a grade.
- The CYU problems are available in the digital Student Edition, and provided to the teacher for copying and distribution in the Assessment Ancillary.



Assessment

Each Concept closes with a Concept Check-In and Remediation lesson. The Concept Check-In is a formative assessment that helps the teacher make instructional decisions. The Concept Check-In is accompanied by suggested strategies for addressing students' lingering misconceptions and errors. Concept Check-In and Remediation activities are available in the digital Teacher Edition. A Unit Assessment is provided at the end of each unit of instruction. This assessment is summative and can be used for a grade.

Primary Mathematics 5

Course Structure

The Primary 5 Mathematics Techbook is a comprehensive teaching and learning package, featuring an easy-to-use digital platform, an interactive print Student Edition, and a print Teacher Edition. This print Teacher Edition provides guidance for teachers to implement high-quality, three-dimensional learning through Hands-On Activities, exploration of mathematics skills and concepts through models, practice, and application, and print and digital assets. This flexibility of resources supports the many variations of classroom settings, so teachers can implement standards-based lessons no matter their particular situation. The digital and print resources work seamlessly together, allowing students to both express thinking on paper and explore ideas and concepts digitally.



Themes

The Primary 5 Mathematics Techbook is organized into four themes that form the structure of mathematics courses from Primary 4 through Primary 6. In each grade, the theme is studied through an applied topic, represented by units within this curricular resource. The themes and Primary 5 units are as follows:

Theme	Primary 5 Units
Theme 1: Number Sense and Operations	1 – Decimal Place Value and Computation 2 – Number Relationships 3 – Multiplication with Whole Numbers
Theme 2: Mathematical Operations and Algebraic Thinking	4 – Division with Whole Numbers 5 – Multiplication and Division with Decimals 6 – Numerical Expressions and Patterns
Theme 3: Fractions, Decimals, and Proportional Relationships	7 – Adding and Subtracting Fractions 8 – Adding and Subtracting Mixed Numbers 9 – Multiplying and Dividing Fractions
Theme 4: Applications of Geometry and Measurement	10 – Two-Dimensional Plane Figures and Coordinate Planes 11 – Volume 12 – Pie Charts and Year-End Review

Concepts

Units are divided into concepts. These concepts break down the major learning of each unit into chunks of instruction. This conceptual approach helps students make sense of new learning in the context of existing understandings and supports their efforts to make connections across skills and concepts.

Lessons

Each concept is composed of a series of lessons. The Unit Structure and Pacing information (available in the digital Teacher Edition) clearly outlines the sequence and duration of each lesson for schools with daily, 60-minute mathematics instructional periods. Alternative pacing is provided to support learning environments that teach math in 45-minute or 90-minute blocks of time.

Lessons typically begin with whole group discussion and instruction and may include partner or small-group, split-classroom, or station rotation learning activities.

- **Whole Group:** Provides an opportunity to bring students together as one whole group to introduce a new concept, engage in rich discussion-based or inquiry-based instruction, or address similar gaps in knowledge and provide instruction to address needs. Whole-class strategies can include Math Talks, Math Language Routines, discussion, teacher demonstrations, and direct instruction.
- **Partner or Small Group:** Allows students to support one another's learning during whole group activities.
- **Split Classroom:** Allows teacher to focus on a topic or skill with up to half of the students in class, while the other half works independently or with a co-teacher.
- **Station Rotation:** Allows students to rotate through stations on a fixed schedule. One of the stations is typically teacher-led, while others can be completed independently or working with a partner.

Tools and Text Features

The tools within every concept in Primary 5 Mathematics Techbook support differentiation for lessons and cater to the different learning preferences of diverse learners. In the digital core interactive text, students and teachers can have text read aloud, highlight important information, or annotate content with sticky notes. Select the text for any concept, and a reader tool will appear.

Digital Teacher Materials

In digital Primary 5 Mathematics Techbook, teachers can not only easily see the student view of content, but they can also access additional support using the Teacher Presentation Mode toggle. Teacher notes, including both the instructional focus and recommended strategy, are included with each activity and are visible to teachers only. In addition, teachers can view sample responses and detailed procedural notes.



Flexible Learning Environment

With the evolution of technology, today's students expect information to be available differently than previous generations of students. Students are accessing information in shorter segments, streaming digital shows, and reading posts through social media. The Primary 5 Mathematics Techbook taps into students' preferences of consuming digital content and provides highly engaging, standards-based content guaranteed to inspire and encourage students to delve deeper into mathematics.

The Primary 5 Mathematics Techbook features rich multimedia resources: video, images, informational text, and more. Online mathematics tools allow all students to access and use tools that mathematicians use to analyze and solve problems, including calculators, geometry tools, construction tools, and whiteboards.

Alternate Pacing Guides

- If Mathematics instruction is based on **60 minutes/5 days a week**, deliver the lessons as written in the Teacher Edition.
- If Mathematics instruction is based on **45 minutes/5 days a week**, do the following:
    - Reduce ACCESS by 3 minutes.
    - Reduce BUILD by 8 minutes.
    - Reduce CONNECT by 2 minutes.
    - Reduce WRAP-UP by 2 minutes.
        - *Strategies for reducing time in each section:*
            - *Discuss fewer examples*
            - *Eliminate Shoulder Partner conversations*
            - *Shorten class discussions*
            - *Work with students to complete ACCESS problems*
- If Mathematics instruction is based on a combination of **45 minutes/4 days a week and 90 minutes 1 day a week**, do the following:
    - Follow the 45-minute approach for the 45-minute days.
    - Teach two 45-minute lessons on the 90-minute day.
- If Mathematics instruction is based on **90 minutes/5 days a week**, do the following:
    - Increase ACCESS by 5 minutes.
    - Increase BUILD by 20 minutes.
    - Increase CONNECT by 3 minutes.
    - Increase WRAP-UP by 2 minutes.
        - *Strategies for increasing time in each section:*
            - *Discuss additional examples as needed*
            - *Extend class discussions*
            - *Allow time for hands-on work with manipulatives and models*
            - *Provide additional practice problems for students who need additional practice*
            - *Encourage students to share and model their problem-solving strategies*

Interdisciplinary Projects: Content and Real-World Connections

A unique addition to the Primary 5 Mathematics Techbook is the Interdisciplinary Projects, provided for students once per term. These Interdisciplinary Projects are based on real-world challenges derived from the United Nations Sustainable Development Goals. Countries across the globe adopted these Sustainable Development Goals in 2015 (with annual monitoring and tracking) to "end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030."[1]



For students to authentically connect to academic content, practice life skills, and deeply understand Egyptian issues, we must provide opportunities for students to search for their own solutions. The Interdisciplinary Projects allow students to do just that. Students are presented with a challenge and then given the opportunity to generate ideas using knowledge and skills from science, mathematics, and other disciplines. Students work with classmates to design a solution to build, test, and refine using the Engineering Design Process.

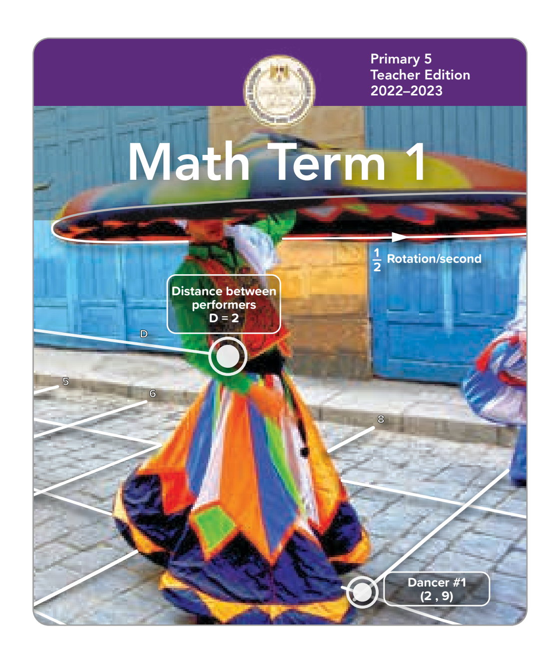
In the first Interdisciplinary Project, "Waste Not, Want Not," students consider the impacts of recycling and repurposing plastic on the environment. They use data to evaluate their own use of various types of waste and learn about the benefits of recycling. Students use the mathematics skills and knowledge to plan and implement a recycling program.



Photo Credit: MOHAMED ABDULRAHEEM / Shutterstock.com

[1] https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

Teacher Edition



The **Primary 5 Mathematics Teacher Edition** is designed to support instructors in the preparation and implementation of rich and engaging learning experiences. It provides clear step-by-step instructions embedded with teacher input, instructional strategies, and classroom management techniques. In these learning experiences, students explore, play, use manipulatives, communicate and collaborate with peers, ask and seek answers to questions, and practice new skills and concepts.

This instructional approach aims to help students accomplish the following goals:

- build numeracy
- discover connections between and among math concepts
- develop computational fluency
- acquire and use math vocabulary
- build awareness of measurement and geometry concepts
- enhance critical thinking, problem solving, collaboration, and communication
- increase enjoyment of math

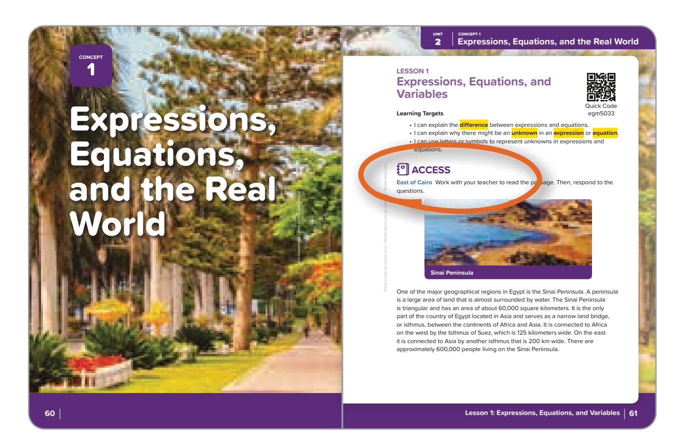
If instructors have not used such a guide before, some practical advice follows:

- Read each unit carefully in advance of instruction. Make notes and highlight important details.
- Prepare in advance to ease your workload and ensure successful learning experiences for students.
- Gather the necessary materials and make any preparations before implementing the lessons.
- Consider additional classroom management techniques necessary for your particular class and learning environment.

Student Edition

The Primary 5 Mathematics Student Edition contains Learning Targets; ACCESS, BUILD, and CONNECT sections; and Index and Glossary pages.

ACCESS



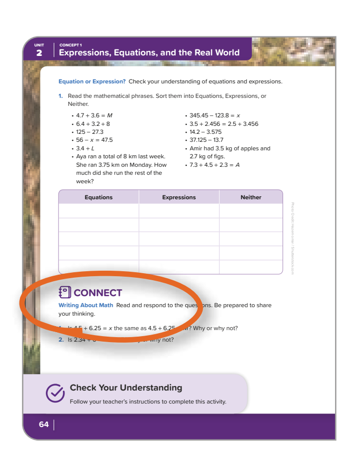
- Students record their work and thinking in their Math Notebook as they participate in the ACCESS activity.
- Students work independently, in pairs, in small groups, or with the whole class to develop computational fluency and build deep conceptual understanding.
- Students work with the teacher and one another to build connections between prior knowledge and new learning.
- Students engage in error analysis to review and reinforce previously learned skills and concepts.
- In error analysis, students review example work (work that was not completed by students in the class) and identify what was done correctly and incorrectly. Students are then given the opportunity to solve the problem on their own. Error analysis is important because it promotes higher-level thinking and aids in conceptual understanding. It also helps students feel comfortable with checking their own work and analyzing their own errors.

BUILD

- BUILD provides an opportunity for students to immediately apply the skills and concepts they are learning in class.
- Students work independently, in pairs, and in small groups to explore, discover, and apply new skills and concepts.
- Students have multiple opportunities to check their work and the work of others. This kind of error analysis strengthens students' learning and deepens their understanding of mathematical concepts and connections.
- BUILD is an excellent resource for informally assessing student progress.

CONNECT

- Students reflect on their learning through drawing, writing, and completing related math activities in their Math Notebook.
- Writing About Math activities provide opportunities for students to make written connections between new content and previous learning and between formal math concepts and the real world.
- CONNECT is another great resource for informally assessing student progress and gathering information about students' current understanding and potential misconceptions.



Resource Pages

Resource pages appear at the end of the print Teacher Edition and online. Resource pages may be photocopied or printed out for student use. They include math tools and resources for students. Students may cut, color, or use resources pages as directed by the teacher.

The information you gather from the ACCESS, BUILD, and CONNECT sections can be used to plan future instruction and differentiation (see Assessment).

Take note of the following:

- What are students discovering or learning? (Content)
- What are students' misconceptions or misunderstandings? (Remediation)
- What are students being asked to do? (Activity)
- What is the teacher discovering about students? (Assessment)
- How could you adapt the lesson for the different abilities in your class? (Differentiation)

During and after the implementation of each lesson, reflect and make notes on what was successful as well as possible suggestions for improvement.

Planning with another instructor can often lead to greater implementation success as it provides an opportunity to discuss classroom expectations, management procedures, and strategies for differentiation according to the needs of students. It is suggested that teachers meet with other instructors at least weekly to plan and reflect.

Formative Assessment

What is formative assessment?

The term *assessment* often brings to mind exams. Exams can be effective at summarizing learning at the end of a chapter, unit, instructional period, or school year. After a student learns material for a certain amount of time, an exam measures how much the student has learned, retained, and can apply. **Formative assessment** encompasses strategies used in the classroom to find out if and how much students are learning along the way, so that instruction can be adjusted.

Why embed formative assessment in instruction?

Formative assessment is a tool that supports responsive teaching. Embedding formative assessment provides instructors with evidence about how much students are learning, retaining, and applying. A teacher who frequently seeks and receives feedback about how much progress students are making toward learning goals can adjust instruction to respond to misconceptions, misunderstandings, and gaps in students' ability to apply learning.

How does embedding formative assessment improve learning?

The following table (William, 2011) provides an overview of five strategies that instructors, peers, and students can use to give and receive evidence of learning throughout the learning process.

	Where the Learning Is Going	Where the Learner Is Right Now	How to Get There
Teacher	Clarifying, sharing, and understanding what we intend for students to learn and the criteria for success	Eliciting evidence of learning	Providing feedback that moves learning forward
Peers		Activating learners as instructional resources for one another	
Learner		Activating learners as owners of their own learning	

Wiliam, Dylan. *Embedded Formative Assessment*. Bloomington: Solution Tree Press, 2011.

The first essential step is to identify (and share with students) the desired learning targets, or "where the learning is going." Once learning goals are established, teachers, peers, and students themselves can check in on "where the learner is right now," or how much progress is being made toward the goals. Rather than assessing whether or not a student has sufficiently learned content after the fact, formative assessment practices provide feedback so that teaching and learning ("how to get there") can be adjusted to better obtain the agreed-upon goals.

What does embedding formative assessment look like in the classroom?

Formative assessment often occurs through classroom discussions and tasks that ask students to explain and justify their thinking. If individual students struggle to understand or apply a concept, a teacher can differentiate instruction or provide peer support to meet that students' needs. Instructors can also gather information about student learning during instruction. For example, by walking around the classroom and checking students' work as they practice new learning in BUILD, teachers can learn a great deal very quickly about students' understanding and misconceptions. When many students exhibit evidence of misunderstanding or gaps in knowledge or skills, a teacher can decide to review, reteach, or present a new approach to achieving the learning goals.

Thinking Like a Mathematician

Students were introduced to the idea of thinking like a mathematician in Primary 3. As students begin to learn more complex and challenging mathematics, learning and practicing these skills and behaviors will help them become thoughtful, responsible learners. The instructor is advised to create a "Thinking Like a Mathematician" anchor chart (as shown below) to display throughout the year.

Good Mathematicians . . .	
Persevere	I can make sense of problems and keep trying.
Represent	I can show what the problem is asking in pictures, numbers, and words.
Explain	I can explain my thinking and work and compare my strategy with others.
Model	I can apply what I know about math in different problems.
Use Tools	I can choose appropriate tools and use them effectively to solve problems.
Are Accurate	I work carefully and check my work to make sure it is accurate and precise.
Use Structure	I can find patterns and use what I know to solve new problems.
Notice Patterns	I can use what I notice to explain rules and shortcuts when solving problems.

There are references to the "Thinking Like a Mathematician" skills and behaviors throughout the lessons. However, it is recommended that the instructor refer students to the anchor chart during instruction whenever possible and helpful, whether or not it is noted in the Teacher Edition.

Instructional Strategies

Many of the instructional strategies described below are woven throughout the Primary 5 Mathematics Teacher Edition. These are not meant to be the only methods used in the classroom; rather, they are highlighted as best practices for engaging students in active, inquiry-based learning. As teachers and students gain familiarity with the strategies, instructors may wish to modify and personalize to suit the needs of each individual classroom.

Instructional Strategy Name	Brief Description
Ask 3 Before Me	Students ask three peers for assistance before asking the teacher. This strategy is used when students are working collaboratively to develop communication skills, encourage peer interactions, and decrease reliance on the teacher's support in large classrooms.
Attention-Getting Signal	The teacher uses an explicit signal to get the attention of the class when they are talking in pairs or working in groups. There are many options for signals, and more than one can be used as long as students recognize it. Options include a clap pattern that students repeat, a simple call and response phrase, or a hand in the air (see: Hands Up). This strategy allows teachers to ask for students' attention without shouting or immediately disrupting student conversations.
Brainstorm	Students provide multiple answers for an open-ended question. This can be done as a whole class or in groups or pairs. The purpose of a brainstorm is to list many answers, not to critique whether answers are realistic, feasible, or correct. Once an initial broad list is made, students can go back to answers to prioritize or eliminate some options. This strategy promotes creativity and problem-solving.
Calling Sticks	The teacher writes the names of students on craft sticks and places them in a can/jar. To call randomly on students, the teacher pulls a stick from the jar. After calling on the student, the teacher places that stick into another can/jar so that student is not immediately called on again. This strategy helps teachers call on a wide variety of students and encourages all students to be ready with an answer.
Count Off	The teacher breaks students into groups by having students count off to a certain number. It is important to tell students to remember their number. For example, if the teacher wants three groups, the first student counts one, the next student says two, the next say three, and the next student starts over at one, and so on. When all students have counted, tell all the number ones to meet together, all the number twos, and then all the number threes. This strategy enables time-efficient grouping and reinforces conceptual number use.
Fishbowl	Students gather around a teacher or group of students who are modeling something new. The students observe carefully as if they are watching fish in a bowl. This strategy promotes the full attention of students even when individual students are not actively participating in the demonstration.

Instructional Strategy Name	Brief Description
Fist-to-Five	Student self-reflect using a "Fist-to-Five," where "fist" indicates no understanding and "five fingers" indicates a deep understanding of all terms.
Four Corners	Each of the four corners of the room corresponds to a possible opinion about a thought-provoking statement. The teacher may post a picture or a prompt in each corner of the room to represent the opinions/statements. Students walk to the corner that interests them or expresses their opinion to group with other like-minded students. This strategy allows students to express opinions and to prepare justifications with others who agree before presenting to the class.
Gallery Walk	As if in a museum, students walk past displays and respond to questions or prompts about the display. This strategy can be used in multiple ways, including to consider ideas posted on chart paper around the room or to view classmates' final products. This strategy encourages diversity of thought. When used at the end of a project, this strategy allows students to celebrate and take pride in their work while also honoring and responding to others' work.
Hands Up	The teacher holds a hand in the air to signal that students should stop what they are doing, stop talking, and look up at the teacher. When students notice the teacher's hand up, they also raise a hand to signal to classmates. This strategy is used as an attention-getting signal.
Hands Up, Pair Up	Students stand and walk around the room quietly with one hand raised in the air. The teacher says, "Stop—Pair Up." Students clap hands and stand together with a nearby student. Anyone with a hand still up needs as a partner. Students can easily find each other and pair up.
I Do, We Do, You Do	I Do: Teacher demonstrates or models an action to take place, such as reading a passage to the students. We Do: Students repeat the action with the teacher, such as re-reading a passage in unison. You Do: Student practices the learned action without the guidance of the teacher. This strategy supports students by modeling an expectation, allowing for low-pressure practice, then providing opportunities for independent practice.
Jigsaw	Students are divided into small "home" groups (for example, groups A, B, C, D, and E). The teacher provides different instruction (or instructional materials) to each "home" group so that each group becomes the "expert" in their unique skill or strategy. For example, there is a group of A experts, B experts, C experts, and so on. The teacher then carefully regroups students so that each new small group has at least one member of each "home" group. For example, each new group will now have one A, one B, one C, and so on. Student experts teach each other what they have learned. This strategy helps students develop ownership of their own learning, confirm their understanding, and build confidence in their mathematical abilities.

Instructional Strategy Name	Brief Description
Lean and Whisper	Students lean one shoulder in toward one neighbor to answer a question that has a one- or two-word (or short) answer. This strategy engages all students in answering a question without disrupting the flow of the classroom.
Model	The teacher or student demonstrates exactly how to complete a task. The rest of the class can ask questions before repeating what was demonstrated. This strategy allows the teacher to review any safety concerns or difficult aspects of a task, as well as share advice for task completion. This method should not be used for some inquiry activities, as it could over-influence the direction of student thinking.
One Stay One Stray	After working with partners, one person stays with the work product to present to other students while the second partner walks around and listens to peers in the class share. Then the two students switch roles. Using the strategy, both partners get to share their project and listen to others share.
Popcorn	Call on one student to answer a question. After the student has answered the question, they say, "Popcorn," and say the name of another student. It is now the turn of that student to answer the question, then pick a new student, and so on. If a student has responded, they should not be called upon a second time during the same Popcorn activity.
Relay Race	Divide the class into teams and have them line up single file. Call one student from each team to the front of the class. Ask students a question and the first to answer receives a point for their team. After answering, the student goes to the end of the line and the next student goes to the front of the room. A variation for math problems is for students to complete only one part of a math problem at a time.
Shake It Share It High Five	Students move around the classroom until the teacher signals to stop. Students then partner with a nearby student. Partners shake hands, share ideas or work products, then high five before moving around again to find a new partner. This strategy gets students out of their seats and moving, while also allowing them to share with classmates they do not sit near.
Shoulder Partners	Students lean and talk quietly with the person sitting next to them. Shoulder Partner can be used literally to just talk to the people sitting on either side, or it can be used for slightly larger groups of three or four with everyone's shoulders "touching." (This promotes the ability to speak softly—in sort of a huddle.)
Snowball Fight	Students respond to a prompt using a half sheet of paper. The student crumples the paper up like a snowball and tosses it across the room. Students pick up a snowball that lands close to them, add their comment or answer, and crumple to toss again. Repeat as needed. The strategy encourages students to interact with the ideas of students who do not sit nearby in an anonymous manner.
Think Aloud	The teacher models a process of thinking by speaking aloud what is thought. As an example, "I think I need more color here in my drawing." This strategy models for students the type of thinking they can use in an upcoming activity.

Instructional Strategy Name	Brief Description
Think Time	The teacher allows a distinct period of silence so that students can process tasks, feelings, and responses. Allow students 15 to 30 seconds to think to themselves before calling on anyone to provide an answer to the class. This strategy is particularly helpful for shy or quiet students, as well as students who prefer to process content individually before contributing to a classroom or group conversation.
Thumbs-Up	The teacher can quickly check for understanding using this strategy. Students hold thumbs up for agreement and thumbs down for disagreement to a question asked by the teacher. Thumbs-Up can also be used as a way for students to signal to a teacher that they are ready for an instruction. Thumbs-Down should never be used to denote disagreement with a student's answer or idea.
Turn and Talk	Students turn "knee to knee" and "eye to eye" with a Shoulder Partner to discuss answers to long-form questions. This strategy allows students to discuss ideas, reflect on learning, and check each other's answers.
Venn Diagram	The teacher draws two or more large overlapping circles as a graphic organizer to show what is the same and different about multiple topics. Teacher notes similarities in the overlapping section of the circles, then summarizes differences in the respective parts of the circles that do not overlap. This strategy allows students to visually see and record similarities and differences.
Wait Time	Similar to the Think Time strategy, the teacher waits at least 7 seconds after asking a question to the whole class or after calling on a student to respond. This provides time for students to think independently before an answer is given out loud.

Differentiated Instruction

Primary 5 Mathematics Techbook allows teachers to differentiate instruction, degrees of readiness, and interests. Techbook also offers resources to help vary content, process, product, and learning environment through the core instructional pathway.

Built upon the principles of Universal Design for Learning, Primary 5 Mathematics Techbook features a variety of content types, including images, video, text, and Hands-On Activities. These resources, included in both digital and print, provide multiple representations of the content and the flexibility for teachers to assign targeted content to whole groups or individual students.

Differentiation Strategies for Teaching Students Who Are Deaf or Blind

Teaching students who are deaf or blind creates various challenges for the instructor and the learner in the classroom environment. Students with these disabilities access their learning environment in unique ways, many of which are drastically different from their hearing and/or seeing peers. Discovery Education provides resources for diverse learners in each unit of the Math Techbook. The following is a list of strategies for teaching students who are deaf/hard of hearing and students who are blind/visually impaired.

Deaf or Hard of Hearing Students

As new vocabulary is frequently absorbed through hearing it within the environment, deaf or hard of hearing students have limited access to learning new terminology; therefore, instructors of deaf or hard of hearing students should consider:

1. Building vocabulary for students by front loading or preteaching the required terms to students prior to the lesson. If the student is able to sign or read lips, ensure the student has adequate understanding of the vocabulary before beginning instruction (Yurechko, 2020).
2. When presenting the student with a visual, ensure the student has ample time to process the visual before continuing the lesson. The processing time may vary depending on the student's needs, but 30 seconds is a good baseline (Yurechko, 2020).
3. Use diverse teaching modalities as often as possible. Use gestures, visuals, manipulatives, symbols, and signs to provide the learner with various means of understanding the material presented (Yurechko, 2020).
4. Multimedia visuals should be used as often as possible. Regardless of reading abilities, provide the student with closed captions when using multimedia resources. Math Techbook videos should be used to assist instruction and provide video resources to students (Yurechko, 2020).
5. Allow time for exploration and independent problem solving (Yurechko, 2020).

Visual Impairments or Blindness

Students with partial or complete vision loss thrive in environments that increase verbal communication and tactile learning. Instructors of students who are blind or have visual impairments should consider:

1. Providing students with assistive technology according to their needs. Assistive technology can aid with typing, reading material presented, and calculations (Smith, 2020).
2. Communication with the students should be in the mode they find most comfortable. Create procedures within the classroom where students and staff announce themselves prior to speaking (Texas School for the Blind and Visually Impaired, 2020).
3. Verbalize all words placed on a board or paper for the student.
4. Increase tactile activities to increase understanding. Consider using manipulatives like an abacus for calculation (Texas School for the Blind and Visually Impaired, 2020).
5. Utilize Math TechBook videos with headphones on higher volume and place students in close proximity to hear (feel the vibrations of sound) the instruction. Allow time and ample opportunities to pause and repeat the material presented until the student reaches understanding.

References

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Texas School for the Blind and Visually Impaired. (2015, June 18). *Possible accommodations for the student with a visual ...* Possible Accommodations for the Student with a Visual Impairment. Retrieved November 20, 2021, from https://www.tsbvi.edu/student-accommodations

Virginia Department of Education, Division of Special Education and Student Services (2017). 2017 Guidelines for Working with Students Who Are Blind or Visually Impaired in Virginia Public Schools [PDF file]. Retrieved from http://www.doe.virginia.gov/special_ed/disabilities/sensory_disabilities/visually_impaired_blind/visually_impaired_guidelines.pdf

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Primary 5 Mathematics Scope and Sequence

An • indicates initial introduction of content. Practice and application should continue beyond initial instruction.

Primary 5 • THEME	1	2	3	4
MATHEMATICS				
A. Numbers and Operations in Base Ten				
1. Apply and extend understanding of the place value system to multi-digit whole numbers.				
a. Demonstrate understanding that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.	•			
b. Explain patterns in the number of zeros in the product when multiplying a number by powers of 10 (for example, the product of a single digit and 1,000 will have three zeroes, while the product of a single digit and 100,000 will have five zeroes).	•			
2. Analyze patterns and relationships.				
a. Generate two numerical patterns using two given rules.		•		•
b. Form ordered pairs consisting of corresponding terms from the two patterns and graph the ordered pairs on a coordinate plane.				•
3. Perform operations with multi-digit whole numbers and with decimals to Thousandths.				
a. Fluently multiply multi-digit whole numbers.	•			
b. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.		•		
c. Add, subtract, multiply, and divide decimals to thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	•	•		

Primary 5 • THEME	1	2	3	4
4. Use place value to read and write decimals to the Thousandths place.				
a. Explain patterns in the placement of decimal points when multiplying or dividing by a power of 10 (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).	•	•		
b. Read, write, and compare decimals up to Thousandths using symbols >, <, and = to represent comparisons.	•			
c. Use place value understanding to round decimals up to the Thousandths place.	•			
B. Numbers and Operations – Fractions and Decimals				
1. Use equivalent fractions as a strategy to add and subtract fractions.				
a. Add and subtract fractions with unlike denominators (including mixed numbers) by: 1) Replacing them with equivalent fractions that have like denominators. 2) Finding the Least Common Multiple (LCM).			•	
b. Solve word problems involving addition and subtraction of fractions (for example by using visual fraction models to represent the problem).			•	
c. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.			•	
2. Apply and extend previous understandings of multiplication and division.				
a. Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$).			•	
b. Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.		•	•	
c. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. 1) Interpret the product $(\frac{a}{b}) \times q$ as a parts of a partition of q into b equal parts. 2) Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths and show that the area is the same as would be found by multiplying the side lengths.			•	•

Primary 5 • THEME	1	2	3	4
d. Interpret multiplication as scaling (resizing) by: 1) Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. 2) Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number.	•	•	•	•
e. Solve real world problems involving multiplication of fractions and mixed numbers.			•	
f. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.			•	
g. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions.			•	
C. Operations and Algebraic Thinking				
1. Use the four operations with decimals to solve problems. Write and interpret numerical expressions.				
a. Add and subtract decimal numbers up to the Thousandths place.	•			
b. Solve word problems of one step on the addition and subtraction of decimal numbers.	•			
c. Multiply and divide decimal numbers by 10, 100, and 1,000.	•	•		
d. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.		•		
e. Interpret the meaning of numerical expressions using parentheses (without solving the expressions).		•		
2. Find common factors and multiples.				
a. Identify common factors of two whole numbers less than or equal to 100.	•			
b. Identify common multiples of two whole numbers less than or equal to 12.	•			

Primary 5 • THEME	1	2	3	4
D. Measurement and Data				
1. Solve problems involving measurement and conversion of measurements.				
a. Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).		•		
b. Use unit conversions in solving multi-step, real world problems.		•		
2. Ask and answer questions by collecting, organizing, and representing appropriate data.				
a. Analyze and interpret data in a pie chart.				•
b. Shade in fractional parts of a circle to represent a given set of data in order to create a pie chart.				•
E. Geometry				
1. Classify two-dimensional figures into categories based on their properties.				
a. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.				•
b. Measure the sides of a triangle.				•
c. Identify types of triangles (right, equilateral, isosceles, scalene).				•
2. Geometric measurement: understand concepts of capacity.				
a. Recognize capacity as an attribute of solid figures and understand concepts of capacity measurement. 1) A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of capacity, and can be used to measure capacity. 2) A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a capacity of *n* cubic units.				•
b. Measure capacity by counting unit cubes, using cubic cm and improvised units.				•

Primary 5 • THEME	1	2	3	4
c. Relate capacity to the operations of multiplication and addition and solve real world and mathematical problems involving capacity.				•
d. Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find the capacity of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.				•
3. Graph points on the coordinate plane to solve real-world and mathematical problems.				
a. Identify the elements of a coordinate system including the axes, the origin, a point, and coordinates.				•
b. Explain the meaning of each number in a coordinate related to position on the plane.				•
c. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.				•

UNIT

1

DECIMAL PLACE VALUE AND COMPUTATION

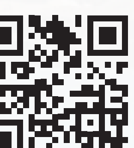
Theme 1 | Number Sense and Operations

ESSENTIAL QUESTIONS

- What patterns exist in our place value number system?
- Why do mathematicians estimate?
- How do mathematicians estimate?
- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Photo Credit: krechet / Shutterstock.com

Video Questions


Quick Code egmt5001

The Unit 1 Opener Video, Place Value Planning, explores math around Egypt through decimals. In this unit, students investigate place value patterns and relationships. They learn strategies to estimate sums and differences as well as add and subtract whole numbers and decimals.

- How did decimals help the students make sense of the world around them?
- What did the students find out about decimals and place value?



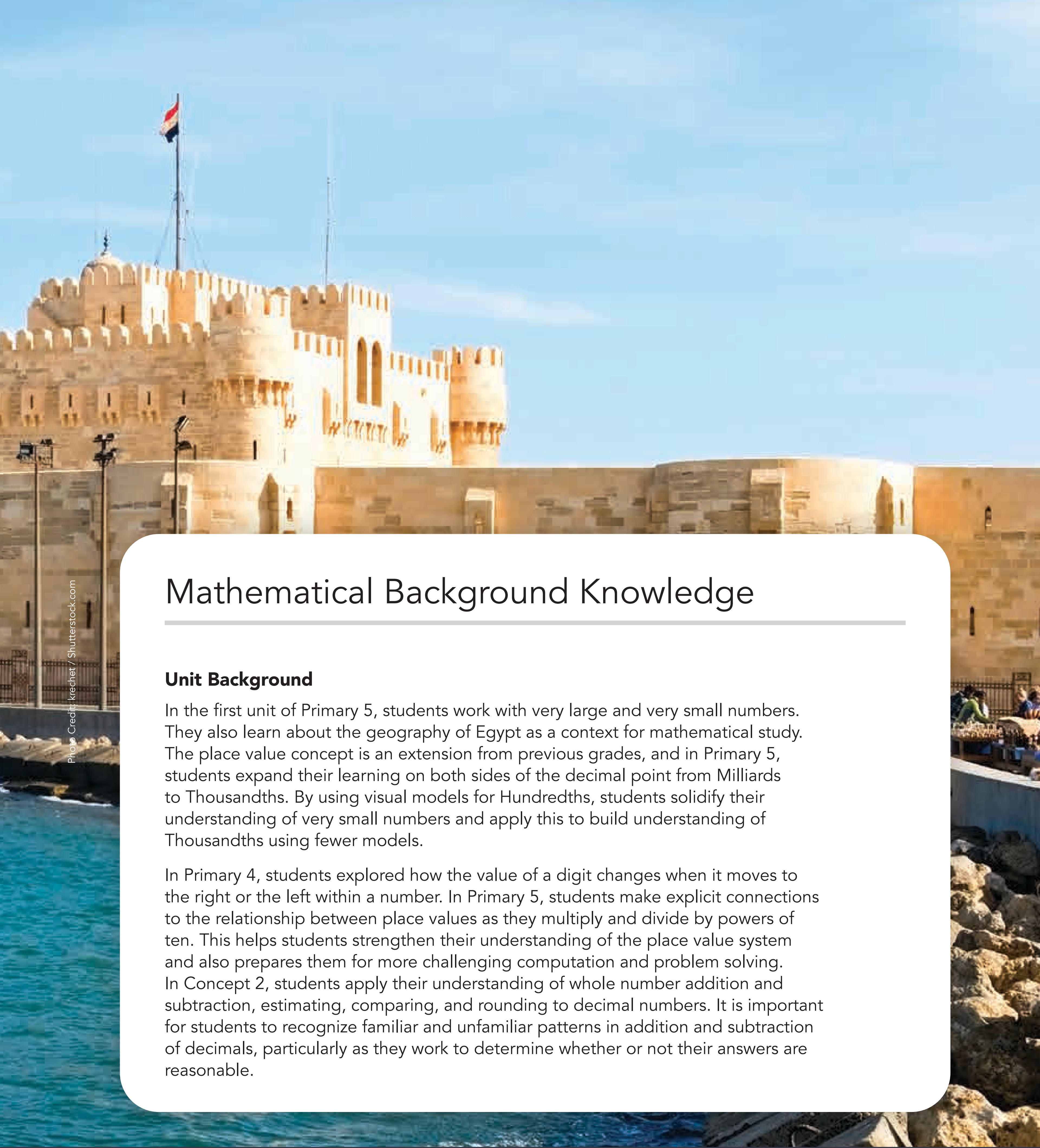
Key Vocabulary


Quick Code egmt5002

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

addend, benchmark, compose, decompose, difference, digit, division, estimate, expanded form, Hundredths, midpoint strategy, Milliards, minuend, multiplication, place value, regrouping, reasonable, round, standard form, subtrahend, sum, Tenths, Thousandths, value





Mathematical Background Knowledge

Unit Background

In the first unit of Primary 5, students work with very large and very small numbers. They also learn about the geography of Egypt as a context for mathematical study. The place value concept is an extension from previous grades, and in Primary 5, students expand their learning on both sides of the decimal point from Milliards to Thousandths. By using visual models for Hundredths, students solidify their understanding of very small numbers and apply this to build understanding of Thousandths using fewer models.

In Primary 4, students explored how the value of a digit changes when it moves to the right or the left within a number. In Primary 5, students make explicit connections to the relationship between place values as they multiply and divide by powers of ten. This helps students strengthen their understanding of the place value system and also prepares them for more challenging computation and problem solving. In Concept 2, students apply their understanding of whole number addition and subtraction, estimating, comparing, and rounding to decimal numbers. It is important for students to recognize familiar and unfamiliar patterns in addition and subtraction of decimals, particularly as they work to determine whether or not their answers are reasonable.



CONCEPT 1

Decimals to the Thousandths Place

Concept Overview

In Concept 1 Decimals to the Thousandths Place, students identify the names of the place value system and the value of digits in each place. They review Milliards to Hundredths and learn about the name and value of the Thousandths place. Students use the place value chart to understand how the value of the digit changes when moved to the left by multiplying by a power of 10 and how a digit's value changes when moving to the right by dividing by a power of 10. Students read and write decimals up to the Thousandths place and review how decimals can be written as fractions. They compose and decompose fractions and decimal numbers using standard form, word form, and expanded form. Students then compare and round decimals.

Concept Standards

5.A.1.a Demonstrate understanding that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.

5.A.4.b Read, write, and compare decimals up to Thousandths using symbols >, <, and = to represent comparisons.

5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

LESSON 1
The Journey Begins

Lesson Overview

In this lesson, students review place value from the Milliards place to the Hundredths place and identify the names and values of digits in the place value system. They begin a Unit 1 journey to the Fayoum region of Egypt to understand how whole and decimal numbers are used in the real world.

Lesson Essential Question

- What patterns exist in our place value number system?

Lesson Learning Objectives

- Students will read numbers from the Milliards place to the Hundredths place.
- Students will identify the value of digits from the Milliards place to the Hundredths place.

Grade-Level Standard

5.A.1.a Demonstrate understanding that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that adding zeros to the right of the last decimal digit does not change its value.
- Students are often confused about how to read decimals. We only say the value of the digit in the last decimal place.
- If students have trouble reading the passages, read them aloud or ask student volunteers to read them aloud.




ACCESS (10 min)

How Big Is the Basin?

Explain to students that the first math theme focuses on the geography of Egypt and the math we can find around the country. Work with students to read the passage. Ask students to complete the learning activity in their math notebook. Then, use Calling Sticks to ask students to share their answers with the class and explain their thinking.

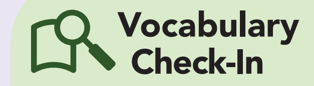
DIGITAL



Quick Code: egmt5003

Preparation

- Create a large Place Value Chart.
- Create a Tenths and Hundredths Anchor Chart.



Vocabulary Check-In

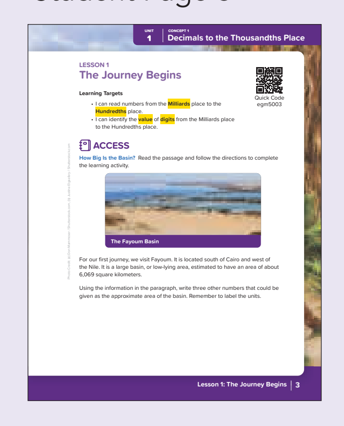
Hundredths, Milliards, place value, Tenths

VIDEO LESSON

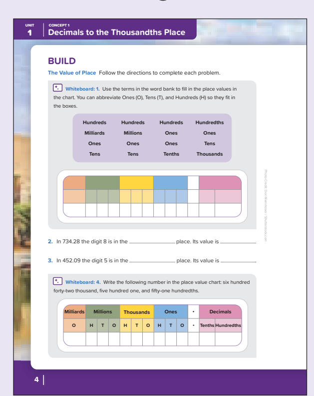


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Student Page 3



Student Page 4


UNIT 1 CONCEPT 1 Decimals to the Thousandths Place

BUILD

Answer Key for How Big Is the Basin

Accept all reasonable answers that are close to 6,069.

BUILD (40 min)




The Value of Place

1. Display the large place value chart and cover the Thousandths place. (The chart will be used in future lessons.) Ask students to share what they remember about place value. Accept all reasonable answers about the terms and values of the places.

2. Write the number 34,560 on the place value chart. Read the number as a class. Ask students questions about the value of the digits to determine their general level of understanding. Tell students that today they will review place values from the Milliards place to the Hundredths place.

3. Write the number 24.67 on the place value chart and ask students to read the number aloud. If necessary, explain how to read decimal numbers. Ask students questions to check their understanding, such as:



- *How many Tens are in this number?* *2*
- *What does the digit 4 represent?* *4 Ones*
- *How many Hundredths are in this number?* *Students may say there is a 7 in the Hundredths place or that the number has 67 Hundredths. Both are correct.*
- *What does the digit 6 represent?* *6 Tenths*

4. Write the following numbers on the place value chart. Ask students to read each one aloud to check their understanding.
   - 406.12 four hundred six and twelve hundredths
   - 34.11 thirty-four and eleven hundredths
   - 89.08 eighty-nine and eight hundredths
   - 234.5 two hundred thirty-four and five tenths

5. Write 1.4 and 1.40 on the place value chart. Ask students if the value of these numbers is the same (Thumbs Up) or different (Thumbs Down). Call on students in each group to explain their thinking with the class.

6. Reinforce that the zero in the hundredths place of 1.40 signifies there is nothing in that place. Tell students that in decimal numbers, zeros can be added to the right of the last non-zero digit without changing the value of the number.

7. Ask students to Turn and Talk to their Shoulder Partner about how they would say these two numbers. Reinforce again that four tenths and forty hundredths are the same amount.

8. Display the Tenths and Hundredths Anchor Chart and use it to show students why these two decimal numbers have the same value. Then, ask students to complete the learning activity.

Answer Key for The Value of Place

Whiteboard: 1.

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths

2. Hundredths place; eight hundredths

3. Tens place; fifty

Whiteboard: 4.

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
				6	4	2	5	0	1	•	5	1

Whiteboard: 5. 977,643,221.0

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
	9	7	7	6	4	3	2	2	1	•	0	

Whiteboard: 6. 10,223,467.79

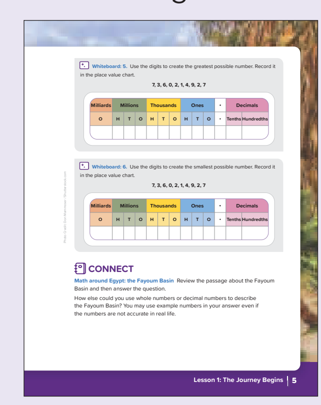
Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
		1	0	2	2	3	4	6	7	•	7	9

CONNECT (7 min) 

Math around Egypt: the Fayoum Basin

Give students 3 to 5 minutes to complete the learning activity. Then, call on several students to share their ideas with the class.

Student Page 5



Answer Key for Math around Egypt: the Fayoum Basin

Answers will vary, but possible answers include the volume, perimeter, depth, or age of the basin.

WRAP-UP (3 min)





Let's Chat About Our Learning

Ask students to reflect on today's Learning Targets and use a Fist-to-Five to show their current confidence level. Call on student volunteers to share what they understand and what they need to continue to work on with place value.

PRACTICE

1. Milliards
2. Tenths
3. 2,000
4. Nine hundredths

Whiteboard: 5.

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
						9	8	8	0	•	2	7



LESSON 2
Decimals to the Thousandths Place

Lesson Overview

In this lesson, students review decimal models to the Tenths and Hundredths. They then create models for thousandths and practice reading and writing decimals to the Thousandths place. Students discuss the value of each digit in a decimal number up to the Thousandths place. Students are encouraged to make connections between what they already know about the place value system and what they are learning about the Thousandths place.

Lesson Essential Question

- What patterns exist in our place value number system?

Lesson Learning Objectives

- Students will read decimal numbers to the Thousandths place.
- Students will write decimal numbers to the Thousandths place.

Grade Level Standard

5.A.4.b Read, write, and compare decimals up to Thousandths using symbols >, <, and = to represent comparisons.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand how to read a decimal number to the Thousandths place.
- Use concrete models to help students understand how a whole can be divided into smaller parts and to help students determine how to name those parts.



ACCESS (10 min)



Birds of the Fayoum Basin

1. Work with students to read the passage, and then have students complete the learning activity. Review the answers as a group.
2. Ask students to explain how they decided which digit was in which place. Next, ask students to talk to a partner about what they think the 5 in 0.875 represents. Answers may vary at this point in the lesson since this is a new concept, but encourage students to think carefully and use what they know about place value as they share their ideas.

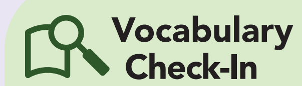
DIGITAL



Quick Code: egmt5005

Materials List

- Unit 1 Lesson 2 Decimal Models
- Unit 1 Lesson 2 Decimal Spinners
- Unit 1 Lesson 2 Large Thousandths Grid (10 blank copies for the teacher)
- Place Value Chart (from Lesson 1)
- Colored pencils or crayons (three different colors per student)



Vocabulary Check-In

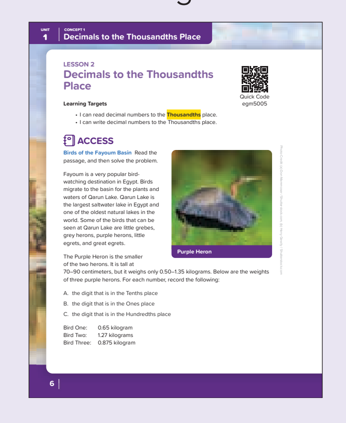
Thousandths

VIDEO LESSON



Quick Code: egmt5006

Student Page 6



UNIT 1 | CONCEPT 1 Decimals to the Thousandths Place

LESSON 2
Decimals to the Thousandths Place

Quick Code egm5005

Learning Targets

- I can read decimal numbers to the Thousandths place.
- I can write decimal numbers to the Thousandths place.

ACCESS

Birds of the Fayoum Basin Read the passage, and then solve the problem.

Fayoum is a very popular bird-watching destination in Egypt. Birds migrate to the basin for the plants and waters of Qarun Lake. Qarun Lake is the largest saltwater lake in Egypt and one of the oldest natural lakes in the world. Some of the birds that can be seen at Qarun Lake are little grebes, grey herons, purple herons, little egrets, and great egrets.

Purple Heron

The Purple Heron is the smaller of the two herons. It is tall at 70–90 centimeters, but it weighs only 0.50–1.35 kilograms. Below are the weights of three purple herons. For each number, record the following:

A. the digit that is in the Tenths place
B. the digit that is in the Ones place
C. the digit that is in the Hundredths place

Bird One: 0.65 kilogram
Bird Two: 1.27 kilograms
Bird Three: 0.875 kilogram

6

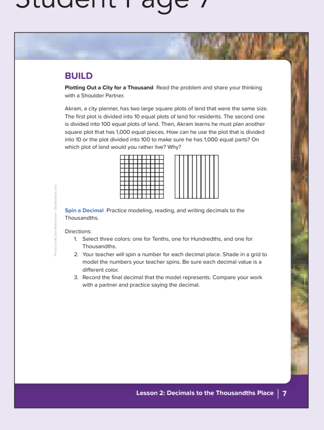
Answer Key for Birds of the Fayoum Basin

A. 6, 2, 8

B. 0, 1, 0

C. 5, 7, 7

Student Page 7



BUILD

Plotting Out a City for a Thousand Read the problem and share your thinking with a Shoulder Partner.

Akram, a city planner, has two large square plots of land that were the same size. The first plot is divided into 10 equal plots of land for residents. The second one is divided into 100 equal plots of land. Then, Akram learns he must plan another square plot that has 1,000 equal pieces. How can he use the plot that is divided into 10 or the plot divided into 100 to make sure he has 1,000 equal parts? On which plot of land would you rather live? Why?

Spin a Decimal Practice modeling, reading, and writing decimals to the Thousandths.

Directions:

1. Select three colors: one for Tenths, one for Hundredths, and one for Thousandths.
2. Your teacher will spin a number for each decimal place. Shade in a grid to model the numbers your teacher spins. Be sure each decimal value is a different color.
3. Record the final decimal that the model represents. Compare your work with a partner and practice saying the decimal.

Photo Credit: Don Mammoser / Shutterstock.com

Lesson 2: Decimals to the Thousandths Place | 7

BUILD (40 min) 

Plotting out a City for a Thousand (10 min)

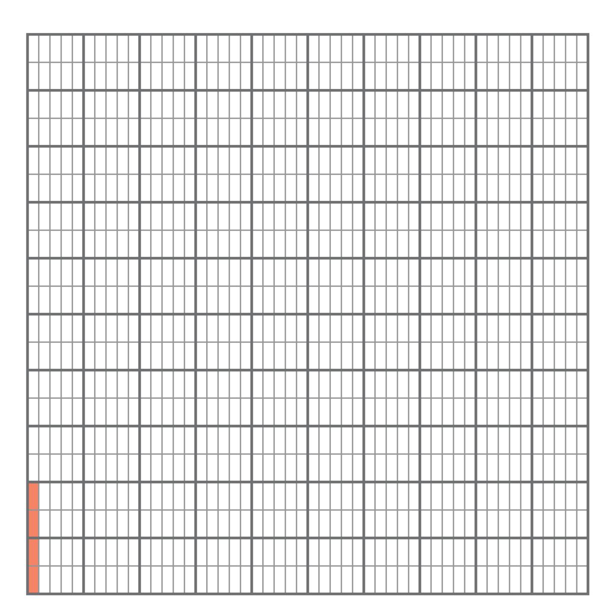
1. Introduce the lesson by telling students that they will begin by reviewing Tenths and Hundredths. Display the Decimal Models. Ask students to share what number each model represents. 0.3, 1.25, 0.76
2. Ask students how many Hundredths are in 1 Tenth? 5 Tenths? 10 Tenths? 10; 50; 100
3. Ask students to discuss the question in the Student Materials with a Shoulder Partner. Then, use Calling Sticks to have two or three students share their thinking.
4. Display a large blank Thousandths grid and ask students to describe what they notice. If necessary, explain that each Hundredths has 10 smaller squares $100 \times 10 = 1{,}000$ and each tenth has 100 smaller squares $100 \times 10 = 1{,}000$. Make sure students can identify Tenths, Hundredths, and Thousandths on the grid.
5. Remind students that one of the Purple Herons weighed 0.875 kg. Uncover the Thousandths place on the large place value chart. Ask students to discuss what the 5 in 0.875 represents. 5 Thousandths

Answer Key for Plotting Out a City for a Thousand

Each one of the Hundredths could be cut into 10 pieces. Each one of the Tenths could be cut into 100 pieces. Students should also recognize that the Tenth plots are larger than the Hundredths and the Thousandths.

Spin a Decimal (30 min) 

1. Display a blank Thousandths grid and ask students to estimate into how many parts the whole is divided. Explain that the whole is divided into 1,000 smaller pieces and that each of those pieces is called $\frac{1}{1000}$ of the whole.



2. Shade in $\frac{4}{1,000}$ on the Thousandths grid and ask students to share what fraction of the whole grid is shaded. $\frac{4}{1,000}$
3. Review that $\frac{4}{10}$ = 0.4, $\frac{4}{100}$ = 0.04 and ask students:

ASK
- *How can we write $\frac{4}{1,000}$? 0.004*
- *Record 0.004 on the place value chart.*
- *How many whole numbers, Tenths, and Hundredths does the number have? 0*
- *How do you know your answer is correct? There are zeros in those places.*

4. Show the 0.76 Decimal Model and ask students to identify how many whole numbers, Tenths, and Hundredths are in the number. 0, 7, and 6 Ask volunteers to read the number aloud. Seventy-six hundredths

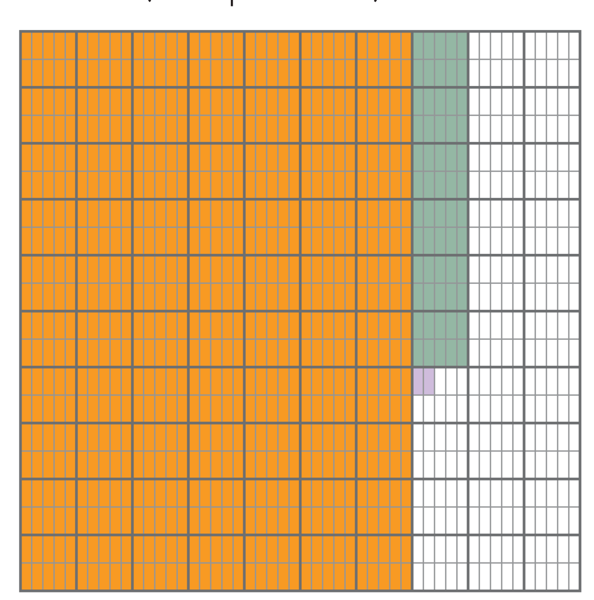
Spin a Decimal
Teacher Note for #4:

Remind students that they read the entire number that is to the right of the decimal and the last digit's place value. This should be a review from Lesson 1, but if confusion persists practice reading a few more decimals.

Spin a Decimal
Teacher Note for #5:

There are many different ways to model this decimal (762 Thousandths; 76 Hundredths and 2 Thousandths; and 7 Tenths, 6 Hundredths, and 2 Thousandths). Ultimately, students should be able to see all these combinations and also recognize that this number cannot be modeled with 76 Tenths, for example, because that would be more than a whole.

5. Ask students to read aloud the number 0.762. Ask students how they could model this decimal using the Thousandths grid. Use a different color to model each place value (example shown).



6. On a new Thousandths grid, shade in 76 Hundredths in one color and 2 Thousandths in another color. Ask students to identify what decimal each color represents and if it still has the same value as the first model. 76 Hundredths and 2 Thousandths. Yes, it still represents 0.762.

7. Repeat, coloring in 762 small squares the same color. Ask, *"Does this still represent 0.762 and how do you know?"* Yes, it represents 0.762 since 762 of the 1,000 squares are colored in. $\frac{762}{1{,}000}$.

8. Display the Decimal Spinners and give each student three different colored pencils. Go over the directions in the Student Materials.

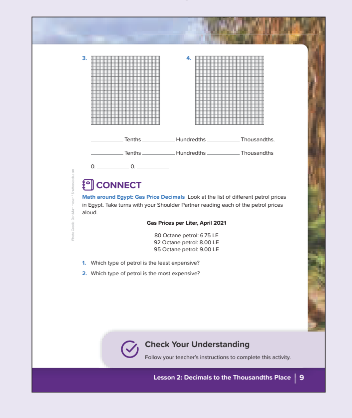
9. As students color, shade in a large Thousandths grid so you can share an example with students. Repeat until the end of BUILD. Discuss, as needed.

Answer Key for Spin a Decimal

1–4. Student grids will vary. Check grids for accuracy.



Student Page 9



CONNECT (7 min)



Math around Egypt: Gas Price Decimals

Ask students to read each decimal number to a partner and answer the questions. Call on two or three students to share their answers.

Answer Key for Math around Egypt: Gas Price Decimals

1. 80 Octane Petrol
2. 95 Octane Petrol

WRAP-UP (3 min)



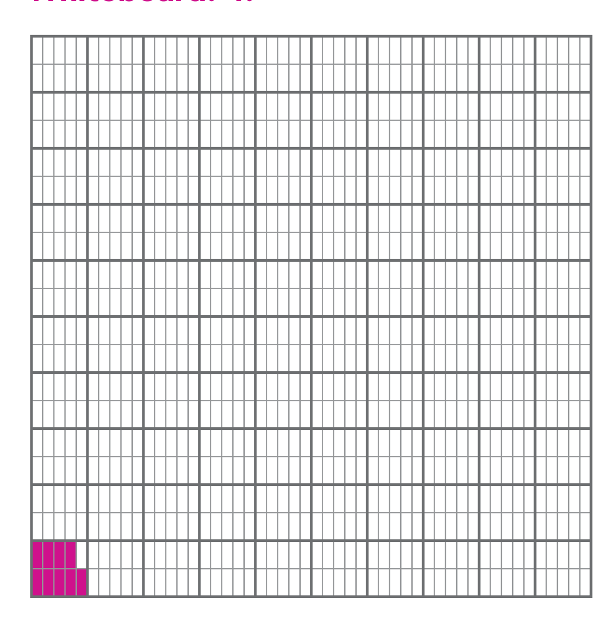
Let's Chat About Our Learning

Ask students to use a Fist-to-Five to reflect on today's Learning Targets. Use Calling Sticks to select a few students to share what they know and what they still need to learn or practice.

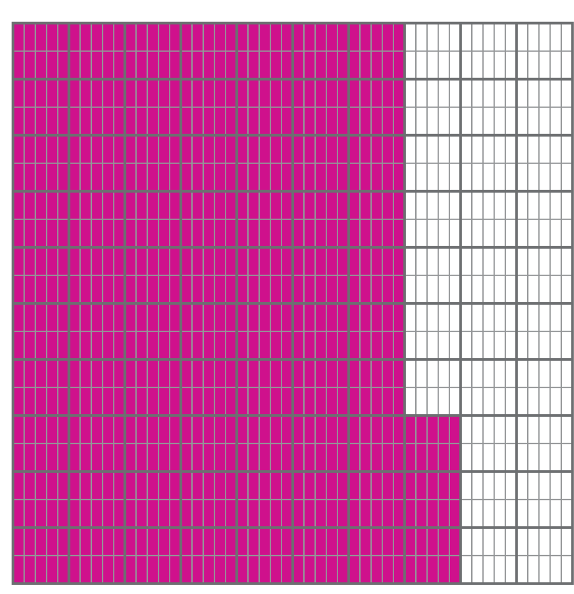
PRACTICE

1. 0.113
2. 0.502
3. 0.371

Whiteboard: 4.



Whiteboard: 5.



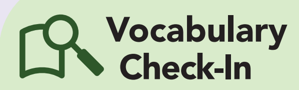
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Materials List

- Large Place Value Chart



Vocabulary Check-In

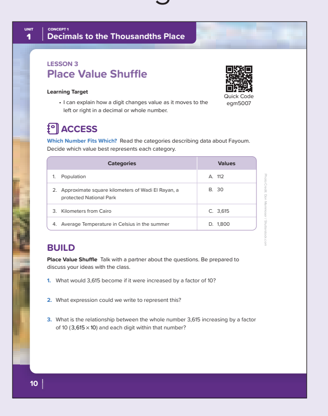
digit, division, multiplication, value

VIDEO LESSON



Quick Code: egmt5008

Student Page 10



UNIT 1 | CONCEPT 1
Decimals to the Thousandths Place

LESSON 3
Place Value Shuffle

Quick Code egm5007

Learning Target

- I can explain how a digit changes value as it moves to the left or right in a decimal or whole number.

ACCESS

Which Number Fits Which? Read the categories describing data about Fayoum. Decide which value best represents each category.

Categories	Values
1. Population	A. 112
2. Approximate square kilometers of Wadi El Rayan, a protected National Park	B. 30
3. Kilometers from Cairo	C. 3,615
4. Average Temperature in Celsius in the summer	D. 1,800

Photo Credit: Don Mammoser / Shutterstock.com

BUILD

Place Value Shuffle Talk with a partner about the questions. Be prepared to discuss your ideas with the class.

1. What would 3,615 become if it were increased by a factor of 10?
2. What expression could we write to represent this?
3. What is the relationship between the whole number 3,615 increasing by a factor of 10 ($3,615 \times 10$) and each digit within that number?

10

LESSON 3
Place Value Shuffle

Lesson Overview

In this lesson, students use their understanding of place value to analyze what happens when a digit moves one place to the left or right within a number. They connect this shift with multiplication and division by 10. Students compare and discuss the value of each digit before and after they shift.

Lesson Essential Question

- What patterns exist in our place value number system?

Lesson Learning Objective

- Students will explain how a digit changes value as it moves to the left or right in a decimal or whole number.

Grade-Level Standard

5.A.1.a Demonstrate understanding that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not yet realize that the entire place value system is a Base Ten system, which means that the value of digits change by a power of 10.
- Students may struggle to conceptually understand decimals (and all numbers less than 1). Consider using Base Ten blocks to help students understand decimals. Use the Thousands cube as One, the Hundreds cube as Tenths, the Tens rods as the Hundredths, and the Ones cubes as Thousandths. The manipulatives will also help students understand the relationships between decimal place values.

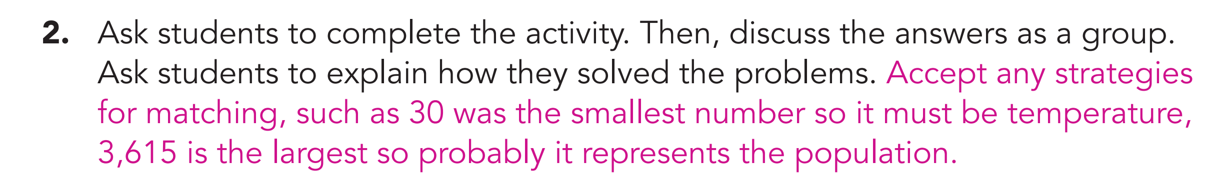


ACCESS (10 min)



Which Number Fits Which?

1. Ask students to talk to a Shoulder Partner about one interesting fact they remember about the Fayoum Basin. Explain that each of the four numbers listed has something to do with the region.



2. Ask students to complete the activity. Then, discuss the answers as a group. Ask students to explain how they solved the problems. Accept any strategies for matching, such as 30 was the smallest number so it must be temperature, 3,615 is the largest so probably it represents the population.

Answer Key for Which Number Fits Which?

1. C
2. D
3. A
4. B

BUILD (40 min) 

Place Value Shuffle (15 min)

1. Write the number 3,615 on the board and ask students to discuss the questions with a Shoulder Partner. Use Calling Sticks to have students share their thinking.
2. Record the equation 3,615 × 10 = 36,150 and record 3,615 on the place value chart to model how each digit moves to the left one spot (see example).

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
						3	6	1	5			
					3	6	1	5	0			

3. Ask students questions about the value of the digits in the new number. Then, ask students to share their own examples of digits changing value when a number is multiplied by 10 or by 100.

Answer Key for Place Value Shuffle

1. 36,150
2. 3,615 × 10
3. The whole number increases ten times and the value of each digit increases ten times.

Ten Is a Powerful Number (25 min) 

1. Remind students that the average summer temperature in the Fayoum Oasis is 30°C. Record 30 on the place value chart. Ask students the following questions:



- *What might happen if instead of moving the 3 Tens digit to the left we moved it to the right? The digit will be ten times smaller.*
- *What equation could you write to represent this shift? 30 ÷ 10*

2. Record 30 ÷ 10 = _____. Model moving the digits from the Tens place to the Ones place and ask, *What is the new value of the 3 digit?* 3

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
								3	0	.		
									3	.	0	

3. Repeat, moving the number 1,800 one place to the right. Repeat once more. Each time ask students to identify the new values of the numbers.
1 Hundred, 8 Tens, 0 Ones; 1 Ten, 8 Ones

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
						1	8	0	0			
							1	8	0	.	0	
								1	8	.	0	0

4. Ask students to describe what happens when they move a digit to the right.
Accept any answer that explains that the value of the digit is ten times smaller.

5. Pose the following questions,



- *What if the number does not end in 0 or 00 like 30 or 1800? The digits still shift to the right, but they might end up on the other side of the decimal point.*
- *What is one-tenth ($\frac{1}{10}$) of this number? 3,615 × $\frac{1}{10}$ or 3,615 ÷ 10 = _____.*

  361.5 Accept any strategy that explains understanding that a number gets smaller and the digits shift to the right.

- *How is dividing by 10 the same as multiplying by $\frac{1}{10}$? In this lesson, the big idea is for students to grasp that the value of a digit increases by 10 (×10) when it shifts to the left and decreases by 10 (÷10) when it shifts to the right.*

6. Write 3,615 on the place value chart and model the shift to the right, as shown.

Milliards	Millions			Thousands			Ones			•	Decimals	
O	H	T	O	H	T	O	H	T	O	•	Tenths	Hundredths
						3	6	1	5			
							3	6	1	.	5	

7. Read the new number aloud together. Ask students to recite the value of the digits in the new number using the following pattern: "The 3 was in the Thousands place and had a value of 3,000. It is now in the Hundreds place and has a value of 300."

8. Ask students:



- *How did each digit's value change as it moved to the right? Each digit decreased 10 times (÷10).*
- *What similarities and differences do you notice between 3,615 × 10 and 3,615 ÷ 10? The digits are the same but when their position changes, their values change.*

9. Ask students to complete Problems 1–3 independently. The first one is completed for them and can be used as a model. Go over the answers together.

Ten Is a Powerful Number
Teacher Note for #6:

It may help to record "× 10" or "÷ 10" on the diagonal lines as you model to reinforce what each place value to the right and left represents.

Answer Key for Ten Is a Powerful Number

1. 5.7

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
		5	7			
			5	•	7	

2. decreased; 5; decreased; 50; 5; 7; decreased; 7; 0.7

3. 65

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
		×10	6	•	5	
		6	5	•		

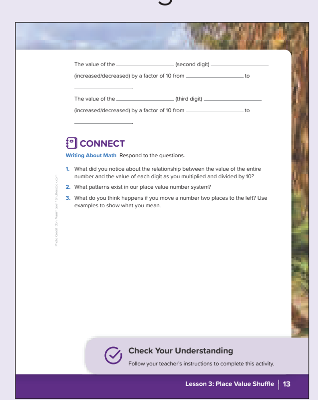
4. increased; 6; increased; 6; 60; 5; increased; 0.5; 5

5. 34.5

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
	3	4	5		÷10	
		3	4	•	5	

6. decreased; 3; decreased; 300; 30; 4; decreased; 40; 4; 5; decreased; 5; 0.5









Writing About Math

Ask students to respond to the prompts. After a few minutes of independent writing, ask students to share their answers with a Shoulder Partner and either add to or adjust their own responses as needed.

Answer Key for Writing About Math

1. When the value of the entire number increases or decreases by 10, the value of each digit within the number also increases or decreases by 10 times.

2. Each place is 10 times larger or 10 times smaller than the one next to it. A digit's value increases 10 times (or is multiplied by 10) when it moves to the left. When it moves the right the digit's value becomes 10 times smaller (or is divided by 10).

3. If a number moves two places to the left, the entire number's value increases by 100 times and each digit also increases by that amount. Students should include an example to illustrate their thinking.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to discuss how today's Learning Target relates to the Lesson Essential Question.

PRACTICE

1. 60; 600
2. 3; 0.3
3. 0.8 (or $\frac{8}{10}$); 80
4. 234
5. Disagree. $34 \times 100 = 3{,}400$ not 340. There are 3,400 pencils.

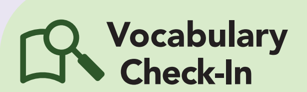
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Quick Code: egmt5009

Materials List

- Place Value Chart



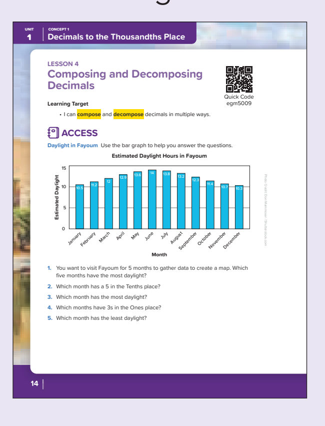
compose, decompose, expanded form, standard form

VIDEO LESSON



Quick Code: egmt5010

Student Page 14



LESSON 4
Composing and Decomposing Decimals

Lesson Overview

In this lesson, students decompose decimal numbers in multiple ways. They begin by reviewing how to write numbers in expanded form and learn that numbers can be decomposed in many different ways. Students are encouraged to use their number sense and recognize that there is often more than one correct answer or strategy in mathematics. Students are also challenged to think creatively and conceptually as they use what they know about place value to create decimal numbers.

Lesson Essential Question

- What patterns exist in our place value number system?

Lesson Learning Objective

- Students will compose and decompose decimals in multiple ways.

Grade-Level Standard

5.A.4.b Read, write, and compare decimals up to Thousandths using symbols >, <, and = to represent comparisons.

COMMON MISCONCEPTIONS AND ERRORS

- Students often find it challenging to decompose decimals using strategies other than writing them in expanded form.
- Students may struggle to see that one large number can be broken apart into endless different combinations. Help students by encouraging them to use what they already know about place value and addition.




ACCESS (10 min)

Daylight in Fayoum

Ask students to read the title and labels of the graph together. Give students five to eight minutes to answer the questions. Use Calling Sticks to select students to share their answers with the class and clear up any misconceptions.

Answer Key for Daylight in Fayoum

1. April, May, June, July, August
2. January
3. June
4. May, July, August
5. December

BUILD (40 min)



Decomposing Decimal Numbers (10 min)

1. Write 625 on the board. Ask students to help you write the number in expanded form (600 + 20 + 5).
2. Tell students that today they will compose and decompose numbers to the Thousandths place in different ways. Ask students to help you with Problem 1. Challenge students to think creatively about other ways the number can be decomposed.

Answer Key for Decomposing Decimal Numbers

Accept any answer that equals 12.42 when composed.

Partner Practice (30 min)

Direct students to work with a Shoulder Partner to complete the learning activity. At the end of BUILD, select two problems to review as a class.

Answer Key for Partner Practice

1.

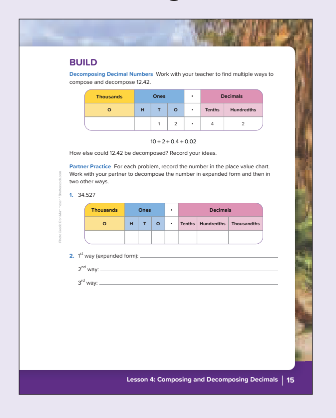
Thousands	Ones			•	Decimals		
O	H	T	O	•	Tenths	Hundredths	Thousandths
		3	4	•	5	2	7

2. 30 + 4 + 0.5 + 0.02 + 0.007; accept all answers that equal 34.527 when composed.

3.

Thousands	Ones			•	Decimals		
O	H	T	O	•	Tenths	Hundredths	Thousandths
		2	1	•	0	4	5

Student Page 15



BUILD

Decomposing Decimal Numbers Work with your teacher to find multiple ways to compose and decompose 12.42.

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
		1	2	•	4	2

10 + 2 + 0.4 + 0.02

How else could 12.42 be decomposed? Record your ideas.

Partner Practice For each problem, record the number in the place value chart. Work with your partner to decompose the number in expanded form and then in two other ways.

1. 34.527

Thousands	Ones			•	Decimals		
O	H	T	O	•	Tenths	Hundredths	Thousandths

2. 1st way (expanded form): ______

2nd way: ______

3rd way: ______

Photo Credit: Don Mammoser / Shutterstock.com

Lesson 4: Composing and Decomposing Decimals | 15

Decomposing Decimal Numbers
Teacher Note for #2:

Give students as much guidance as needed. They will formally add decimal numbers later; the focus of this lesson is place value and developing students' number sense. If needed, refer to Lesson 2 where they played Spin the Decimals and thought about how 0.762 could be recorded as 7 Tenths, 6 Hundredths, and 2 Thousandths or 76 Hundredths and 2 Thousandths.

4. 20 + 1 + 0.04 + 0.005; accept all answers that equal 21.045 when composed.

5.

Thousands	Ones			•	Decimals		
O	H	T	O	•	Tenths	Hundredths	Thousandths
		1	4	•	9	3	2

6. 10 + 4 + 0.9 + 0.03 + 0.002; accept all answers that equal 14.932 when composed.

7.

Thousands	Ones			•	Decimals		
O	H	T	O	•	Tenths	Hundredths	Thousandths
	2	3	1	•	1	2	8

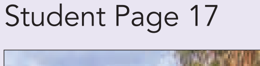
8. 200 + 30 + 1 + 0.1 + 0.02 + 0.008; accept all answers that equal 231.128 when composed.

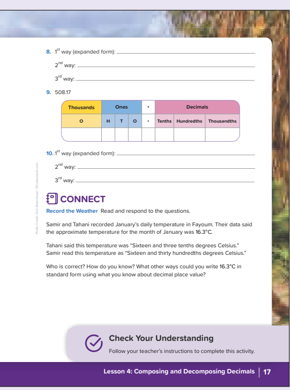
9.

Thousands	Ones			•	Decimals		
O	H	T	O	•	Tenths	Hundredths	Thousandths
	5	0	8	•	1	7	5

10. 500 + 8 + 0.1 + 0.07; accept all answers that equal 508.17 when composed.

Student Page 17





CONNECT (7 min)

Record the Weather

Ask students to read and respond to the questions. After a few minutes of independent writing, ask students to share their answers and explain their thinking.

Answer Key for Record the Weather

Both students are correct. 16.3 is the same thing as 16.30 and can be read as sixteen and three tenths or sixteen and thirty hundredths.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to discuss the following question with their Shoulder Partner: *What strategies did you use to decompose decimal numbers?* Call on students to share their thinking with the class.

Listen for students to share effective strategies, such as using the place value chart because it helps keep track of the digits; focusing on splitting the digit into parts, for example, 8 can be broken into two fours; and focusing on one place value by further breaking it apart. For example, just thinking about all the ways 0.4 can be further decomposed.

PRACTICE

1. 40 + 2 + 0.01; accept all answers that equal 42.01 when composed.
2. 600 + 70 + 1 + 0.4 + 0.08; accept all answers that equal 671.48 when composed.
3. 398.68
4. 4,070.091

Challenge b, c

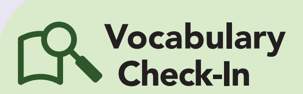
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Quick Code:
egmt5011

Materials List

- Place Value Chart



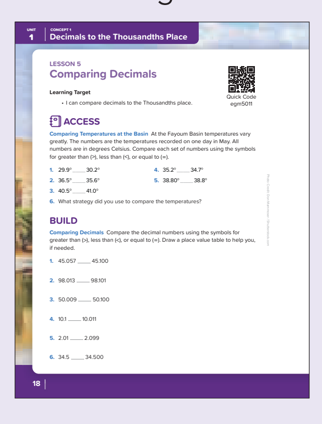
compose, decompose, expanded form, standard form

VIDEO LESSON



Quick Code:
egmt5012

Student Page 18


Decimals to the Thousandths Place

LESSON 5
Comparing Decimals

ACCESS

BUILD

LESSON 5
Comparing Decimals

Lesson Overview

In this lesson, students compare decimal numbers to the Thousandths place. They practice stacking numbers inside a place value chart to help them compare each digit's value and determine which number is greater. Students extend their understanding of zeros in decimal numbers to see that a decimal number may have fewer, or more, digits but still have the same value.

Lesson Essential Question

- What patterns exist in our place value number system?

Lesson Learning Objective

- Students will compare decimals to the Thousandths place.

Grade-Level Standard

5.A.4.b Read, write, and compare decimals up to Thousandths using symbols >, <, and = to represent comparisons.

COMMON MISCONCEPTIONS AND ERRORS

When comparing decimal numbers, students may think the number with more digits is always greater. If necessary, use concrete models such as Base Ten blocks to help students understand how to compare decimals.





Comparing Temperatures at the Basin

Ask students to complete the learning activity. After several minutes, review the answers as a class and call on students to explain the strategy they used.

Answer Key for Comparing Temperatures at the Basin

1. <
2. >
3. <
4. >
5. =
6. Answers may include comparing each place value one at a time, stacking the numbers on top of each other, or moving from left to right until one number has a greater digit.

BUILD (40 min) 

Comparing Decimals

1. Ask students to talk with their Shoulder Partner about how they use place value to compare decimals. Call on students to share their thinking with the class.
2. Write the following two numbers side by side on the board and vertically: 34.399 and 34.400. Ask students to point to the number pair that is easiest to compare.

   34.399 and 34.400

   34.399
   34.400
3. Call on a student who chose the horizontal pair and then call on a student who chose the vertical. Students should see that, by aligning the numbers vertically, they can move from left to right and compare place values.
4. Ask students to compare the two numbers and give a Thumbs Up when they know which is greater. Call on a student to share their thinking. 34.400 is greater because when moving from left to right the digits are the same until the Tenths place. At that point they can see that the 4 is greater than the 3.
5. Erase the zeros in 34.400 and ask students to talk with their Shoulder Partner and determine if this number is still greater than 34.399. Call on students to share. Students should see that no matter how many numbers come after the 4 in the Tenths place, 34.4 will still be greater than 34.399 because Hundredths and Thousandths are smaller than Tenths.
6. Ask students to complete Comparing Decimals independently. Use the last few minutes of BUILD to check answers together.

Answer Key for Comparing Decimals

1. <
2. <
3. <
4. >
5. <
6. =
7. 1.49
8. 20.001

CONNECT (7 min) 

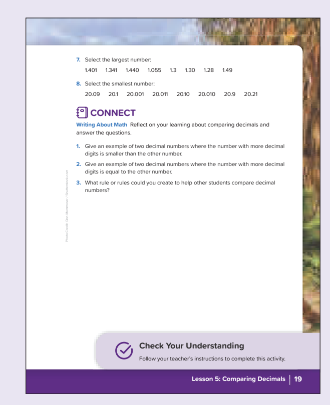
Writing About Math

Ask students to respond to the questions. Explain that many decimal numbers could be used for both problems. After a few minutes, call on volunteers to share their answers with the class.

Answer Key for Writing About Math

1. Accept all answers that meet the criteria.
2. Accept all answers that meet the criteria. One decimal number should have extra zeros to the right of the last digit or the left of the decimal point.

Student Page 19



3. Answers will vary but may include: If comparing decimal numbers and one is smaller but has more digits, the value of the last digit in the number with fewer digits will be greater than the value of the digit in the same place in the other number. If two decimal numbers are equal, one could still have more digits if zeros are added to the last non-zero digit to the right of the decimal.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to explain the strategies they use to compare decimals. Reinforce effective strategies.

PRACTICE

1. <
2. <
3. =
4. 34.04 and 34.040
5. 28.9°; 28.9°; 29.1°; 29.3°; 34.2°; 34.3°; 34.5°

LESSON 6
Rounding Decimals

Lesson Overview
In this lesson, students apply their understanding of rounding to decimal numbers. They review the midpoint and Rounding Rule strategies they learned in Primary 4. They then apply the strategies to round decimal numbers to the nearest Tenth, Hundredth, or Thousandth.

Lesson Essential Question
- What patterns exist in our place value number system?

Lesson Learning Objective
- Students will round numbers to the nearest Tenth, Hundredth, or Thousandth.

Grade-Level Standard
5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

COMMON MISCONCEPTIONS AND ERRORS

- When finding a midpoint between two consecutive single numbers or two consecutive decimal numbers, students may not understand that 2.5 is the midpoint between 2 and 3 or that 3.75 is the midpoint between 3.7 and 3.8.
- When rounding to a number less than 1, students may not understand that the whole number remains.




ACCESS (10 min)

Waterfall Region: Error Analysis
Work with students to read the passage. Ask students to work independently to complete the error analysis. Go over the answers together.

Answer Key for Waterfall Region: Error Analysis
1. The student did realize that the number needed to have Hundredths and that the 5 Tens would not change.
2. The student did not understand that 9 Tenths is almost one whole, so instead of having 0 Ones there would be 1. The student does not have a good understanding of rounding with decimals.
3. 51 km^2.

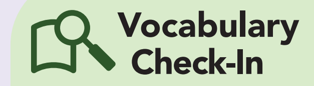
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Quick Code: egmt5013

Materials List
- Colored pencils

Preparation
- Create a Rounding Rule poster.



Vocabulary Check-In

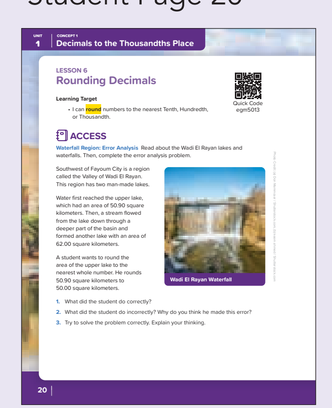
Hundredths, midpoint strategy, Tenths, Thousandths

VIDEO LESSON

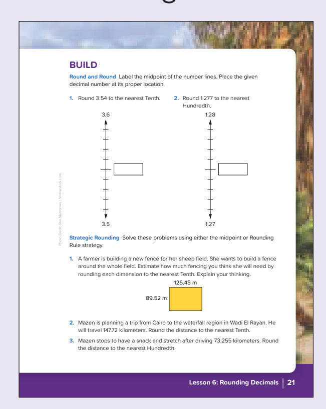


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Student Page 20



Student Page 21



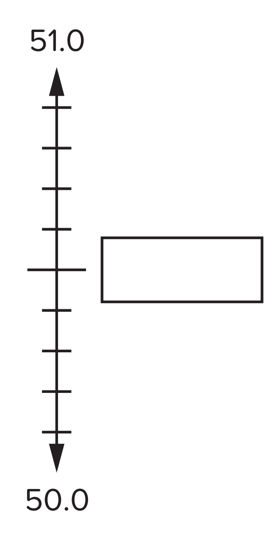
Round and Round
Teacher Note for #2:

When looking at a vertical number line between two consecutive single digits or two consecutive Tenths, it is important to clarify that there are still ten smaller numbers between the two. Each line on these vertical number lines is $\frac{1}{10}$, $\frac{1}{100}$, or $\frac{1}{1000}$ (or 0.1, 0.01, or 0.001) of the whole. Additionally, students will most often be asked to round to the nearest Tenth or Hundredth when working with decimals, but it requires an understanding of Thousandths to do so.

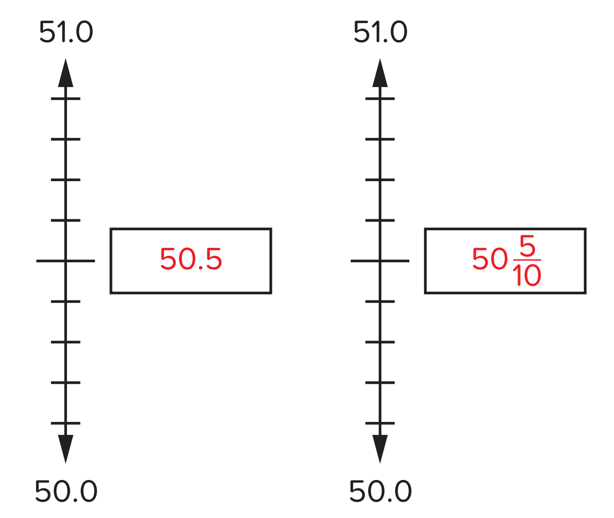
BUILD (40 min) 

Round and Round (15 min)

1. Ask students to talk to their Shoulder Partner about what strategies they use to round whole numbers to a certain place value. Call on students to share their thinking.
2. Draw a vertical number line on the board as shown.

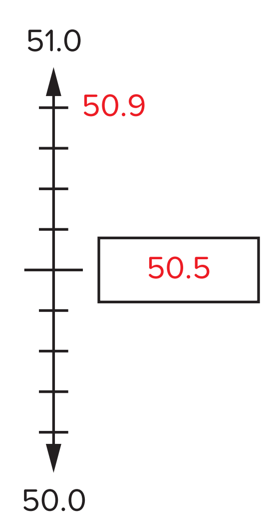


3. Remind students that in Primary 4 they used the midpoint strategy to help them visualize the rounding process. Ask a student to label the midpoint of the line using a fraction and a decimal. If necessary, clarify that each mark on the line is $\frac{1}{10}$ or 0.1 and explain that the midpoint is a fraction of a whole. $50\frac{5}{10}$, 50.5





4. Label 50.9 on the line and ask students:



ASK

- *How can we confirm this is the correct placement for 50.9? Answers may vary.*
- *How could this vertical line help the student in the ACCESS problem understand that 50.9 should be rounded to 51? Each mark is 0.1, and 50.9 is closer to the next whole number, 51.0. Place value helps us understand that if a number is at or above the midpoint, we round up.*

5. Ask students to label the first vertical number line with a midpoint and the listed decimal.

6. Call on a student to share how they labeled and then ask:



- *How did you decide what the midpoint would be? 3.55 is in between 3.5 and 3.56. There are ten parts in between each decimal representing* $\frac{1}{100}$.
- *How did you decide where the listed decimal would go? 3.54 is below 3.55.*
- *When rounding to the nearest Tenth, how many digits will there be after the decimal point? 1*
- *What is 3.54 rounded to the nearest Tenth? Why? 3.54 rounds to 3.5 because .04 is below the midpoint, so the 5 in 5 Tenths does not change.*
- *Why does the 3 remain and 3.54 not just round to 0.5? The 3 represents the Ones place and therefore stays. The only digit that is being altered is the Tenths place, either by going up or staying the same.*

7. Repeat the process with Problem 2. Midpoint will be 1.275, which rounds to 1.28.

8. Post the Rounding Rule poster and ask volunteers to help explain the rule. Write the number 4.2688 on the board. Then, ask students to discuss each of the following questions with a partner and share their thinking with the class. Clarify as needed.



- *What would this number be rounded to the nearest whole number?* 4
- *What would this number be rounded to the nearest Tenth?* 4.3
- *Rounded to the nearest Hundredth?* 4.27
- *Rounded to the nearest Thousandth?* 4.269

Answer Key for Round and Round

1. 3.5 or 3.50; 3.55 should be in box (midpoint)
2. 1.28 or 1.280; 1.275 should be in box (midpoint)

Strategic Rounding (25 min)

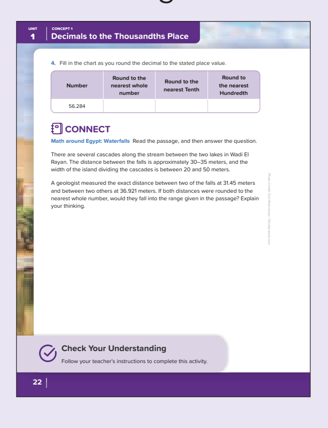
Ask students to complete the learning activity using either rounding strategy. At the end of BUILD, go over the answers to Round and Round and Strategic Rounding together.

Answer Key for Strategic Rounding

1. 430 m, 430.0 m, or 430.00 m; students should explain the strategy they used
2. 147.7 km
3. 73.26 km
4.

Number	Round to the nearest whole number	Round to the nearest Tenth	Round to the nearest Hundredth
56.284	56	56.3	56.28

Student Page 22





CONNECT (7 min)



Math around Egypt: Waterfalls

Work with students to read the passage. Then, give students three to five minutes to complete the learning activity. Call on several students to share their work with the class. Clear up misconceptions.

Answer Key for Math around Egypt: Waterfalls

No. 36.921 rounds to 37, which is outside the range listed.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to consider the following question: *How can being able to round numbers help you be a better mathematician?* Use Calling Sticks to hear from as many students as time allows.

PRACTICE

1. 6.23; 6.17
2. 5.249; 5.247; 5.251
3. 3.5
4. 1.4
5. 10.7

Challenge 4.75; 4.76; 4.77; 4.78; 4.79; 4.80; 4.81; 4.82; 4.83; 4.84

DIGITAL



Quick Code: egmt5015

CONCEPT CHECK-IN AND REMEDIATION
Decimals to the Thousandths Place

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Decimals to the Thousandths Place. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed in the chart, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Question

- What patterns exist in our place value number system?

Lesson Learning Objective

- Students will correct misconceptions and errors related to working with decimals.

Concept Standards

5.A.1.a Demonstrate understanding that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.

5.A.4.b Read, write, and compare decimals up to Thousandths using symbols <, >, and = to represent comparisons.

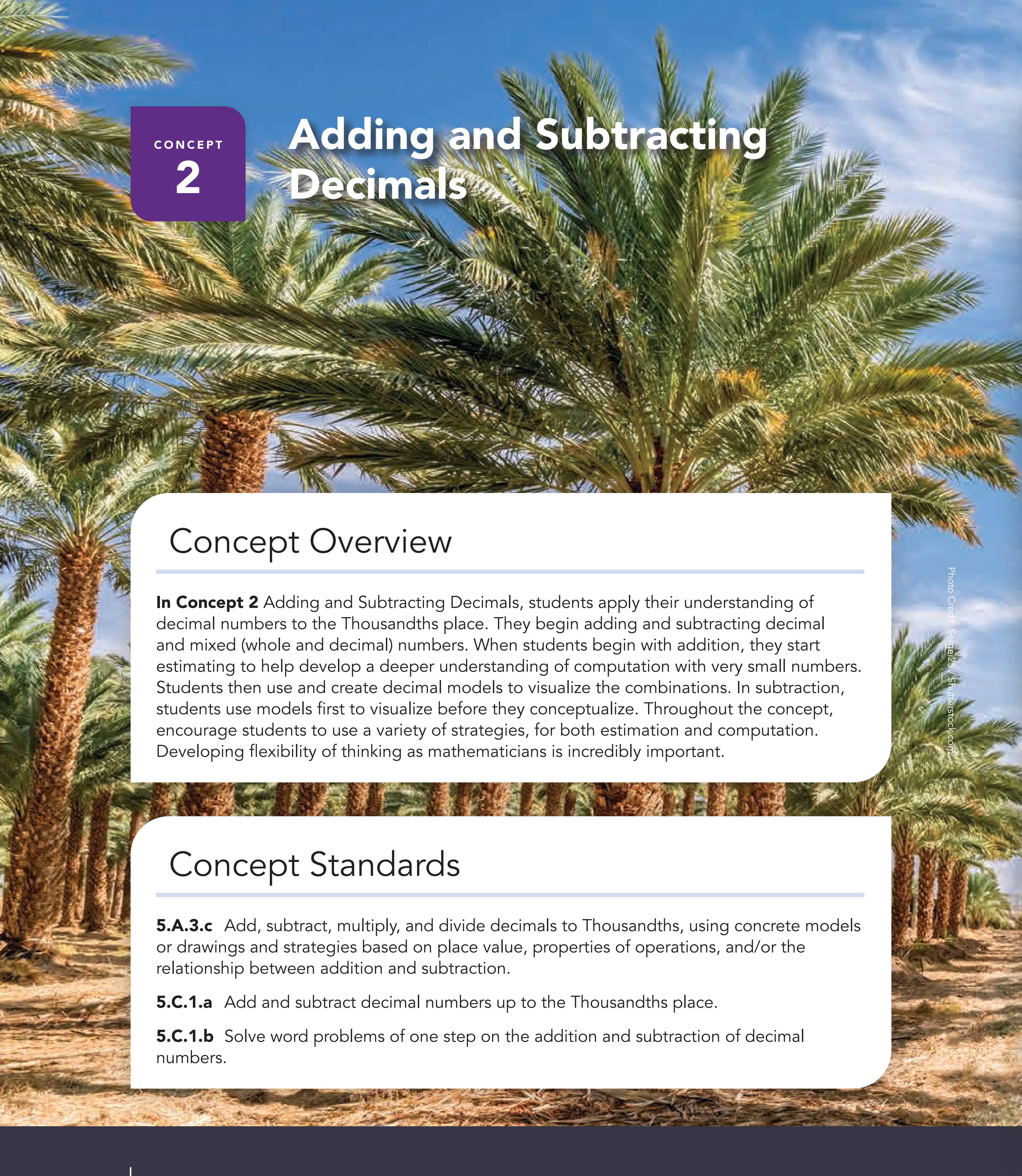
5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that adding zeros to the right of the last decimal digit does not change its value.
- Students are often confused about how to read decimals.
- Students may not understand how to read a decimal number to the Thousandths.
- Students may not yet realize that the entire place value system is a Base 10 system.
- Students often find it challenging to decompose decimals beyond expanded notation.
- Students may struggle to see that one large number can be broken apart into endless different combinations.
- When comparing decimal numbers, students may think the number with more digits is always greater.
- When rounding to a number less than 1, students may not understand that the whole number remains.

Remediation: Correcting Misconceptions

If . . .	Then . . .
Students do not understand that adding zeros to the right of the last decimal digit does not change its value.	Review the place value charts in Lessons 1 and 3. Students can also make decimal numbers using models and see that the zero can be represented by a blank Thousandths model (the model is there, but it holds no value). Students can also practice reading these decimals.
If . . . Students struggle to read decimal numbers to the Thousandths.	**Then . . .** Review Lesson 2 using models and place value charts to build decimals to the Thousandths place and practice reading them.
If . . . Students do not recognize that the value of each digit in a number changes when all of the digits move to the right or left.	**Then . . .** Review Lesson 3 and practice solving a variety of "Original value, New value" problems. Students can use the place value chart and record how each digit changes as it moves.
If . . . Students think the number with more digits is always greater.	**Then . . .** Review the place value charts in the unit and Lesson 5 BUILD to practice stacking numbers and comparing values. Consider using Base Ten blocks to help students visually compare decimal numbers. Consider using Base Ten blocks to help students understand decimals. Use the Thousands cube as One, the Hundreds cube as Tenths, the Tens rods as the Hundredths, and the Ones cubes as Thousandths. The manipulatives will also help students understand the relationships between decimal place values.
If . . . Students are unable to find the midpoint between two whole numbers or two decimal numbers.	**Then . . .** Review Lesson 6 and provide additional practice with a vertical number line and the midpoint strategy.



CONCEPT 2

Adding and Subtracting Decimals

Concept Overview

In Concept 2 Adding and Subtracting Decimals, students apply their understanding of decimal numbers to the Thousandths place. They begin adding and subtracting decimal and mixed (whole and decimal) numbers. When students begin with addition, they start estimating to help develop a deeper understanding of computation with very small numbers. Students then use and create decimal models to visualize the combinations. In subtraction, students use models first to visualize before they conceptualize. Throughout the concept, encourage students to use a variety of strategies, for both estimation and computation. Developing flexibility of thinking as mathematicians is incredibly important.

Concept Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one step on the addition and subtraction of decimal numbers.

LESSON 7
Estimating Decimal Sums

Lesson Overview
In this lesson, students begin to explore computation with decimal numbers. They consider what happens as we get closer to a whole with decimal parts. They use different strategies to round as another way to estimate. Students also discuss how rounding to different place values changes the exactness of an estimate and what types of problems need more exact estimations.

Lesson Essential Questions
- Why do mathematicians estimate?
- How do mathematicians estimate?

Lesson Learning Objective
- Students will estimate sums of decimal numbers.

Grade-Level Standards
5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

COMMON MISCONCEPTIONS AND ERRORS
- Students may struggle to estimate with mixed numbers because they do not see them as parts and wholes.
- Students may not understand how to round to a variety of place values.


ACCESS (10 min)

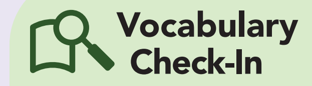

Getting Close to a Whole
1. Ask students to respond to the prompts. After a few minutes, ask students to share their responses with a partner. Then use Calling Sticks to have several students share.

DIGITAL

Quick Code:
egmt5016

Materials List
- Rounding Rule poster from Lesson 6

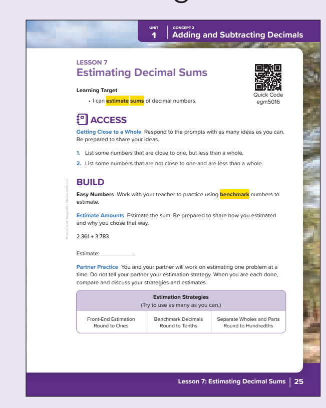
Preparation
- Create a Benchmark Decimal Numbers Chart (see BUILD).
- Create a Rounding Anchor Chart (see BUILD).


Vocabulary Check-In
addend, benchmark, estimate, round, sum

VIDEO LESSON

Quick Code:
egmt5017

Student Page 25


UNIT 1 | CONCEPT 2 Adding and Subtracting Decimals

LESSON 7
Estimating Decimal Sums

Quick Code
egm5016

Learning Target
- I can estimate sums of decimal numbers.

ACCESS
Getting Close to a Whole Respond to the prompts with as many ideas as you can. Be prepared to share your ideas.
1. List some numbers that are close to one, but less than a whole.
2. List some numbers that are not close to one and are less than a whole.

BUILD
Easy Numbers Work with your teacher to practice using benchmark numbers to estimate.

Estimate Amounts Estimate the sum. Be prepared to share how you estimated and why you chose that way.

2.361 + 3.783

Estimate: ____________

Partner Practice You and your partner will work on estimating one problem at a time. Do not tell your partner your estimation strategy. When you are each done, compare and discuss your strategies and estimates.

Estimation Strategies (Try to use as many as you can.)		
Front-End Estimation Round to Ones	Benchmark Decimals Round to Tenths	Separate Wholes and Parts Round to Hundredths

Lesson 7: Estimating Decimal Sums | 25

2. Ask students questions to help spark a discussion about estimating when adding decimals, such as:



- *What is a decimal number? A part of a whole.*
- *What happens when we add decimal numbers? We get closer to a whole.*
- *What is a mixed number? A number with both wholes and parts.*
- *What happens when we add mixed numbers? We will have wholes and maybe some extra parts.*
- *What is an estimate? A way to get close to an answer.*
- *Why do mathematicians estimate? To quickly calculate costs, distances, and so on.*
- *How do mathematicians estimate? Answers will vary but may include front-end estimation, rounding, using benchmark numbers.*
- *When might we need to estimate with decimal numbers? Answers will vary—accept any reasonable response.*

Answer Key for Getting Close to a Whole

1. Accept all answers that meet the criteria.
2. Accept all answers that meet the criteria.

BUILD (40 min) 

Easy Numbers (15 min)

1. Tell students that today they will learn several ways to estimate decimal number sums. The class will learn and practice a few together and then they will practice estimating on their own. Write the following problem on the board: 0.43 + 0.56 = _____. Ask students the following questions about the problem:



- *What do you notice about these addends? Answers may vary but reinforce both are Hundredths and close to 0.5, or one-half (a benchmark number).*
- *Using what you know about benchmark numbers (like half), what do you estimate the sum to be for this problem? About 1 whole*

2. Repeat Step 1 for these problems:
   - 0.6 + 0.48 About 1 whole
   - 0.399 + 0.55 About 1 whole

3. Ask students to name benchmark decimal numbers for one-half and record them on the Benchmark Decimal Numbers Chart. 0.5; 0.50; 0.500.

4. Ask students to name benchmark decimal numbers for 0 and record them on the Benchmark Decimal Numbers Chart. 0.1; 0.01; 0.001 (the more digits in a decimal number, the closer we get to zero).
5. Ask students to name benchmark decimal numbers for 1 and record them on the Benchmark Decimal Numbers Chart. 0.9; 0.99; 0.999 (there are others too, but the closer the digits are to 9 and the more digits there are, the closer we get to one whole).
6. Tell students that when there are mixed numbers, we can still use benchmark numbers to estimate the sums of the fractional parts.
7. Reinforce that using benchmark numbers like 0, 0.5, and 1 are one way to estimate. Tell students that another way to estimate sums is to use front-end estimation (looking at the first digit and ignoring the rest), separating wholes and parts (considering the wholes and the parts separately), and rounding. Ask a volunteer to review the definition of rounding. Rounding uses place value to get us to a number that is close but not exact. We can round to various place values.
8. If students struggled to round in Lesson 6, divide the class into 3 groups (or groups of 3, if easier). Assign each group (or each person in a group) a place value—either Hundredths, Tenths, or Ones. Write the numbers shown here on the board, one at a time, and ask each group (or each person in a group) to round to their assigned place value. After a few moments of group discussion, ask volunteers to record their answers on the board. Repeat as needed.
    - 2.133 Hundredths: 2.13; Tenths: 2.10 (or 2.1); Ones: 2
    - 5.803 Hundredths: 5.80 (or 5.8); Tenths: 5.8; Ones: 6
    - 9.555 Hundredths: 9.56; Tenths: 9.6; Ones: 10

Easy Numbers
Teacher Note for #8:

Encourage discussion about what students notice about rounding each number. For example, when we round to Hundredths, we write two digits after the decimal point, unless there is a 0, then we can write just one digit after the decimal point. Whenever we round numbers, we look at the digit in the place value to the right. If needed, review the Rounding Rule.

Estimate Amounts (10 min)

1. Ask students to work independently to estimate the sum. After a few minutes, ask volunteers to share their answers and strategies for estimating. Display the Rounding Anchor Chart for students' reference.
2. Ask students to discuss the following questions:



- *Would you estimate the same way if you had a large number such as 3,453.23 and a small number such as 2.35? Answers will vary, but may recognize that rounding to the Tenths or Hundredths will not change the value of a number greatly in either case.*
- *Was your estimated answer close to the actual answer? Answers will vary.*
- *What could you have done to make your estimate closer to the actual answer? When students round to the lowest place value their answer will be closest to the exact answer.*

Estimate Amounts
Teacher Note for #2:

Students may recognize that rounding to the smallest place value will give them the most accurate estimate. However, it also becomes more difficult to perform mental math and the strategy is not the most efficient.

- *What place value would you round to in order to find an estimate closest to the exact sum? Hundredths*
- *What place value would you round to in order to find the quickest estimate? Answers may vary; ask students to explain their thinking.*

3. Ask students to discuss when it might be necessary to round to the lowest decimal place and when front-end estimation would be the best tool for estimating. Front-end estimation is an easy way to quickly get an idea of a sum. It also helps students to see if their exact answer is reasonable or not. However, sometimes they may need to estimate to a decimal place. An example of this may be when dealing with money.

Answer Key for Estimate Amounts

Accept estimates between 5 and 6.2.

Partner Practice (10 min)

Go over the directions and ask students to complete the learning activity.

Answer Key for Partner Practice

1–5. Accept all reasonable estimates.

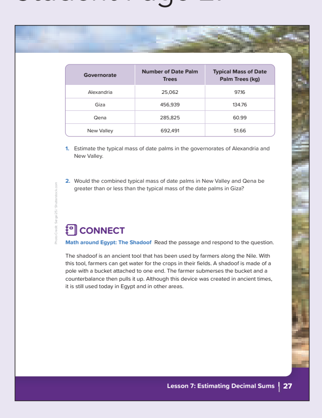
More Partner Practice (5 min)

Use the last several minutes of BUILD to have student pairs share what they discovered about their estimates.

Answer Key for More Partner Practice

1. Accept all reasonable estimates.
2. Less than

Student Page 27



CONNECT (7 min)



Math around Egypt: The Shadoof

Work with students to read the passage, and then ask them to respond to the question. After a few minutes, ask students to share their answers and explain how they decided to round their numbers for their estimates.

Answer Key for Math around Egypt The Shadoof

About 400 liters of water

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to discuss the estimation strategy they preferred and why. Encourage students to use mathematical terms.

PRACTICE

1. 5
2. 5.5 (or 5)
3. 10 (or 10.3;10.4)
4. 8.7 (or 8; 8.73; 8.74)
5. 10 (or 10.0; 10.01)

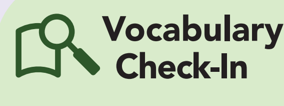
DIGITAL



Quick Code:
egmt5018

Materials List

- Large Place Value Chart
- Colored pencils or crayons (two different colors per student)



addend, sum

VIDEO LESSON



Quick Code:
egmt5019

LESSON 8
Modeling Decimal Addition

Lesson Overview

In this lesson, students use and create models to add two decimals together. With a focus on models in this lesson, students develop a strong conceptual understanding of what happens when parts of a whole are added. They also learn what happens as that sum reaches and surpasses a whole and how to flexibly combine decimals to reach a sum. Students show the relationship between adding whole numbers and decimal numbers and they practice regrouping with models.

Lesson Essential Question

- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objective

- Students will model decimal addition.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one step on the addition and subtraction of decimal numbers.

COMMON MISCONCEPTIONS AND ERRORS

Students may not line up decimal numbers correctly by place value, particularly when adding decimal numbers with different amounts of digits.



ACCESS (10 min)



The Nile River

1. Work with students to read the passage, and then have students respond to the questions. Ask students to share their answers as you record them on the board.

2. Ask students questions to check their understanding, such as:



- *Which rounded number is closest to the actual distance? Why? Rounding to the Tenths place is closest to the actual distance because the Tenths place has the smallest value in the number.*
- *When might you use an estimated distance? In common conversation people use estimated distances. They say things such as, "The distance between Alexandria and Khartoum is about 2,000 kilometers."*
- *Who might use an exact distance? Example: The transportation industry (airlines, trains, and boats).*

Answer Key for The Nile River

1. 2,000 km
2. 2,400 km
3. 2,407 km
4. 2,406.70 km

BUILD (40 min)



A Model Decimal, Express the Model, Whiteboard: Make a Model, Record Decimals, and Decimal Addition (15 min)

1. Remind students of the models they made for decimals. Explain that the model in their Student Materials shows the addition of two decimal number addends. Each addend is represented by a different color. Ask students to complete Problems 1 and 2.

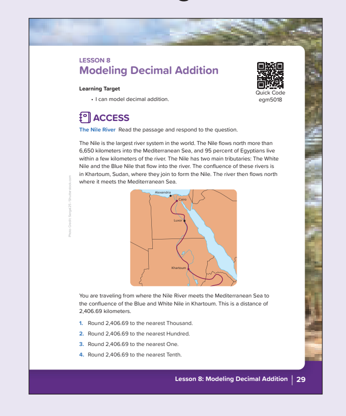
2. Write the numbers in the large place value chart while saying the problem aloud.

3. Ask students to estimate the sum. Use Calling Sticks to have a few students share. Estimates may vary but should be between 0.5 and 1.

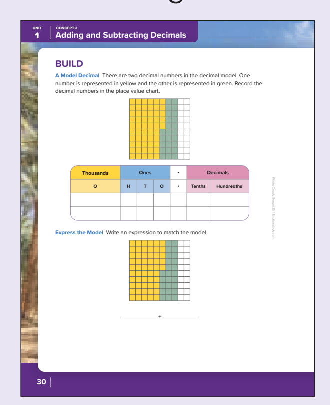
4. Ask students to explain how this equation is similar to and different from adding the whole numbers 55 + 25. Students can apply what they know about solving whole number equations to decimal equations. If 55 + 25 = 80, then the digits for adding 0.55 and 0.25 will be the same (0.80).

5. Ask students to explain how 55 and 0.55 are different. What types of things might they visualize to think about these numbers? 55 is a much larger number. Even though both numbers have the same digits, place value is extremely important: 0.55 is less than 1 whole.

Student Page 29



Student Page 30



6. Ask two volunteers to solve the equation on the board. Have one student use the model in the Student Materials. Have the other student use the place value chart to find the sum. Ensure that both students get the correct answer.

7. Ask students to work with a partner to complete Problems 3–5. When students are finished, ask the following questions:



- *How did the model help you solve the problem?* Answers may vary.
- *What strategies did you use to solve the problem?* Accept accurate strategies.
- *Did any partners fill in one whole model? What does that mean?* If students filled in one whole model, it means they have one whole number.
- *How far is your sum to the nearest whole number? How could you use the model to help you figure that out?* Students can count the blank spaces on the model to determine how far they are to the nearest whole.

Answer Key for A Model Decimal

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
			0	•	5	5
			0	•	2	5

Answer Key for Express the Model

0.55 + 0.25

Answer Key for Whiteboard: Make a Model

Models will vary.

Answer Key for Record Decimals

Answers will vary.

Answer Key for Decimal Addition

Answers will vary.

Model Makers, Whiteboard: Modeling, More Model Makers, Whiteboard: Model Addition, Evaluate More, Whiteboard: Model the Expression, Solve, Whiteboard: Model Another Expression, Evaluate and Estimate, Whiteboard: Model the Expression Again, Evaluate Again (25 min)

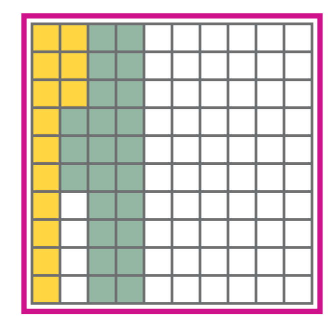
Ask students to work independently to estimate sums, create decimal models, and solve addition problems. After about fifteen to twenty minutes, go over the answers together. Ask students to discuss how they solved the problems.

Answer Key for Model Makers

0.30 or 0.3

Answer Key for Whiteboard: Modeling

Accept all accurate models. Example:



Answer Key for More Model Makers

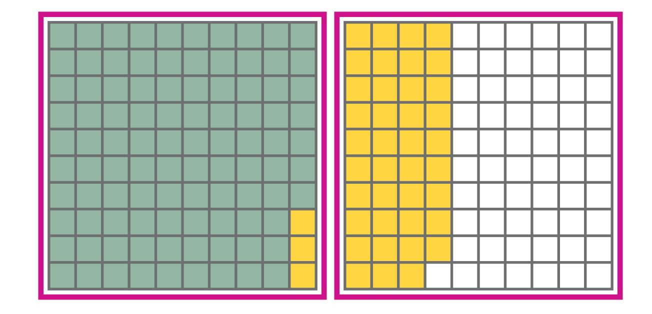
1.

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
			0	•	1	3
			0	•	2	3

2. 0.36
3. 1.4

Answer Key for Whiteboard: Model Addition

Accept all accurate models. Example:



Answer Key for Evaluate More

1.

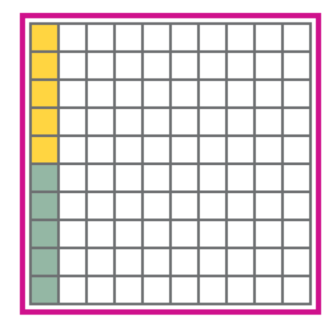
Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
			0	•	9	7
			0	•	4	2

2. 1.39

3. 0.1 (or 0.2)

Answer Key for Whiteboard: Model the Expression

Accept all accurate models. Example:



Answer Key for Solve

1.

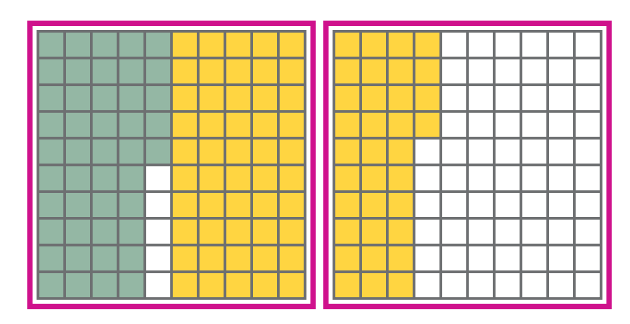
Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
			0	•	0	5
			0	•	0	5

2. 0.10 (or 0.1)

3. 1.3 (or 1.5)

Answer Key for Whiteboard: Model Another Expression

Accept all accurate models. Example:



Answer Key for Evaluate and Estimate

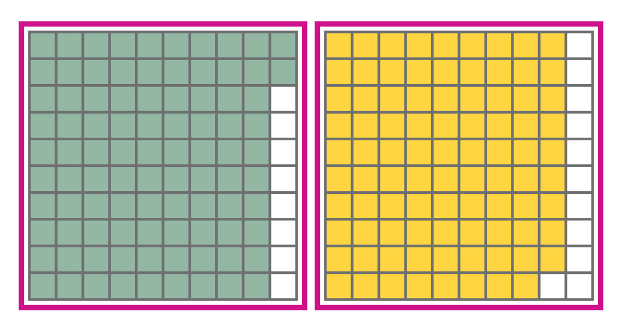
1.

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
			0	•	4	5
			0	•	8	4

2. 1.29
3. 1.8 or 2

Answer Key for Whiteboard: Model the Expression Again

Accept all accurate models. Example:



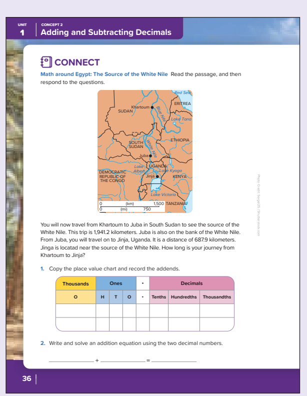
Answer Key for Evaluate Again

1.

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
			0	•	9	2
			0	•	8	9

2. 1.81

Student Page 36





CONNECT (7 min)

Math around Egypt: The Source of the White Nile

Work with students to read the passage, and then ask them to respond to the question. After a few minutes, ask volunteers to share their answers and explain their thinking.

Answer Key for Math around Egypt: The Source of the White Nile

1.

Thousands	Ones			•	Decimals	
O	H	T	O	•	Tenths	Hundredths
1	9	4	1	•	2	0
0	6	8	7	•	9	0

2. 1,941.2 + 687.9 = 2,629.1 km or 1941.2 + 687.9 = 2629.1

WRAP-UP (3 min)

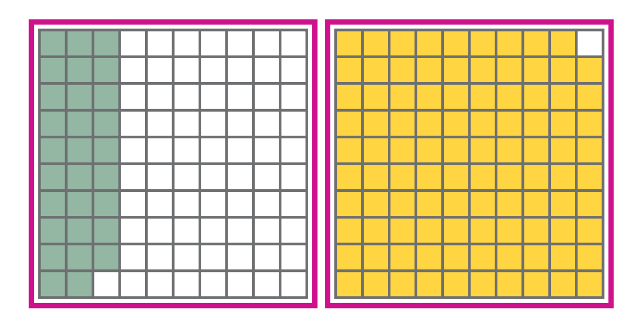


Let's Chat About Our Learning

Ask students to discuss the three strategies they used today: estimation, models, and equations. Which strategy did they prefer? Why?

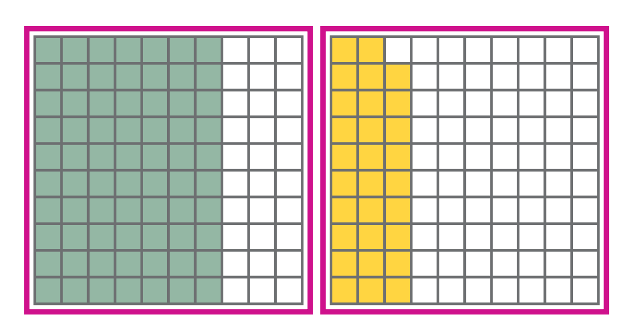
PRACTICE

1. 0.13 + 0.29 = 0.42
2. 0.57 + 1.23 = 1.80
3. Accept all accurate models. Example:



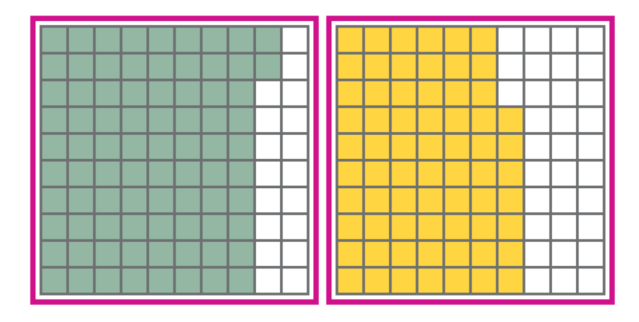
4. 1.28

5. Accept all accurate models. Example:



6. 0.99

7. Accept all accurate models. Example:



8. 1.49

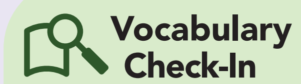
DIGITAL



Quick Code:
egmt5020

Materials List

- Thinking Like a Mathematician Anchor Chart
- Decimal Spinners (one set per small group of students)



Vocabulary Check-In

addend, reasonable, sum

VIDEO LESSON



Quick Code:
egmt5021

LESSON 9
Thinking Like a Mathematician

Lesson Overview

In this lesson, students connect their learning from the previous lessons by using estimation as a way to determine if a sum is reasonable. They first look at the addends to determine the place value of the sum. Then, they solve addition problems with decimal numbers to the Thousandths, first estimating and then finding the actual sum. They strengthen their ability to estimate and discuss how estimation helped them check the reasonableness of their answers.

Lesson Essential Questions

- Why do mathematicians estimate?
- How do mathematicians estimate?
- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objectives

- Students will apply strategies to add decimals to the Thousandths place.
- Students will check the reasonableness of their answers.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to round decimal numbers in order to estimate.
- Students may not understand that, when adding decimals, if the addends have numbers to the Hundredths place, the sum may have numbers in the Hundredths place but never the Thousandths place.



ACCESS (10 min)



Blue Nile versus White Nile

Work with students to read the passage. Direct students to work independently to respond to the question. After students are finished, have them discuss their thinking with a partner. Then, as a group, discuss which rounding strategy was closer to the actual answer and what other strategies students might use to mentally solve this problem.

Answer Key for Blue Nile versus White Nile

5,149.90 km. Zeina is closer to the actual answer because she rounded to a smaller place value which made the two addends closer to the original numbers. Students may share other mental math strategies that they used such as rounding the decimals separately or decomposing the numbers into place value and then composing back.

Blue Nile Versus White Nile
Teacher Note:

Developing a strong number sense includes having the ability to think about the best ways to round a number to support mental computation. Estimation and rounding to varied place values also enables students to check the reasonableness of their actual answers.

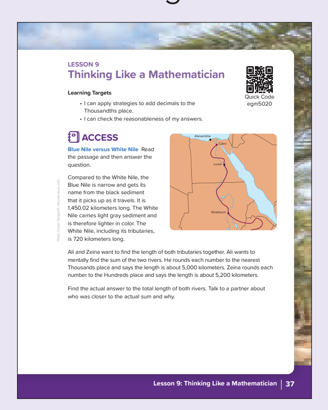
BUILD (40 min)



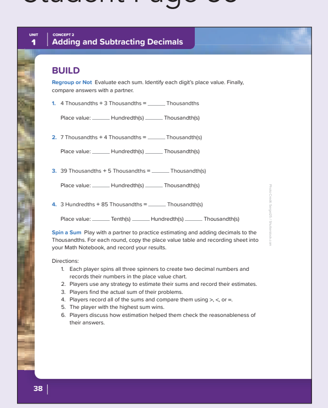
Regroup or Not (15 min)

1. Display and review the Thinking Like a Mathematician Anchor Chart. Explain that today students will be working on several of the practices, including perseverance, accuracy, and using the structure of place value to solve problems.
2. Ask students to complete Problems 1–4 independently and share their answers with a partner. After a few minutes, ask questions to help students review regrouping (particularly how, when, and why).
3. If needed, model regrouping using one of the problems from the Student Materials using a decimal model (as in Lesson 8) and a place value chart.
4. Record the following problems on the board: 23.65 + 15.008 = _____ and 98 + 995 = _____. For each problem, ask students to give a Thumbs Up if it requires regrouping and a Thumbs Down if it does not.
5. For each problem, ask students to predict how many decimal places the sum will have and explain how they know. The first problem will have three decimal places because the largest addend has three decimal places. The second number will have no decimals because the addends do not have decimals.

Student Page 37



Student Page 38



6. Ask students to help you solve the two problems. Then, ask volunteers to share their thinking about the relationship between the number of digits in the decimal addend and the number of decimal places in the sum. Ask students to explain whether or not it is possible to have a decimal number to the Thousandths place if the two addends go to the Hundredths place. If one of the addends has Hundredths, then the sum will either have just Tenths or Hundredths. It will never have a digit in the Thousandths place. This is very different than when we add whole numbers. Having 10 Hundredths would make a Tenth, not a Thousandth.

Answer Key for Regroup or Not

1. 7 (Thousandths); 0 (Hundredths) 7 (Thousandths);
2. 11 (Thousandths); 1 (Hundredth) 1 (Thousandth)
3. 44 (Thousandths); 4 (Hundredths) 4 (Thousandths)
4. 115 (Thousandths); 1 (Tenth) 1 (Hundredth) 5 (Thousandths)

Spin a Sum (25 min)

1. Explain to students that mathematicians often check their work by asking themselves if their answer is reasonable. They use estimation or other mental math strategies to support or revise their thinking.
2. Ask students to explain how they know the sum of a problem is reasonable. Reinforce that mathematicians use a variety of estimation strategies and also think about the place value of the addends. By thinking about the problem before solving, and then checking the sum with the estimate, we can determine if our calculation is reasonable.
3. Use Hands Up, Pair Up to put students into pairs. Go over the directions for Spin a Sum. Model game play, if necessary.
4. Allow time for partners to play Spin a Sum. As students work, walk around and check their estimation and addition answers. Offer help as needed. Use the last five minutes of BUILD to ask students to explain how checking the reasonableness of their answers makes them better mathematicians.

Answer Key for Spin a Sum

Recorded decimals, estimations, sums, partner sums, and comparisons will vary.



CONNECT (7 min)



Writing About Math

Ask students to respond to the prompt. After a few minutes of independent writing, ask students to share their answers and explain their thinking.

Answer Key for Writing About Math

1. Both whole numbers and decimals can be added using an understanding of place value. Regrouping occurs with whole numbers and decimals.
2. It is different because it is important to line up the decimals and to consider what happens when you add Tenths to Hundredths. With decimal numbers, the number with the most decimal places tells you how many decimal places will be in the answer. With whole numbers, the number of digits in each addend will not necessarily determine the number of digits in the final sum.

WRAP-UP (3 min)



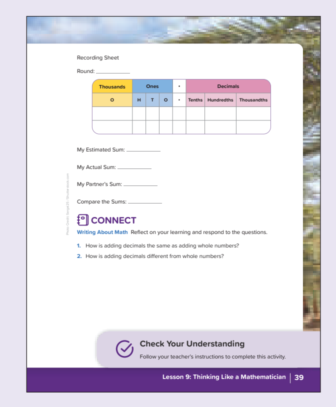
Let's Chat About Our Learning

Ask students to use a Fist-to-Five to reflect on the Learning Targets. Have student volunteers share their reflections with explanations.

PRACTICE

1. 38.067
2. b
3. 120
4. 120.05
5. 77.701

Student Page 39



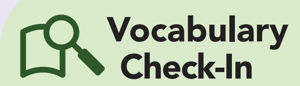
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Quick Code:
egmt5022

Materials List

- Colored pencils or crayons (one color per student)
- Decimal Models from Concept 1 (optional)



Vocabulary Check-In

difference, minuend, regrouping, subtrahend

VIDEO LESSON



Quick Code:
egmt5023

LESSON 10
Subtracting Decimals

Lesson Overview

In this lesson, students solve decimal subtraction problems with models. Students interpret and draw models to help them understand regrouping with decimals. The order of the decimal subtraction lessons is intentionally different than for the order of the lessons for addition. At the beginning of this concept, students began a conceptual exploration. In this learning sequence, students extend this understanding and deepen it with models and practice. At the end of BUILD, students use a place value chart to support a connection to the standard algorithm for decimal computation.

Lesson Essential Question

- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objective

- Students will model decimal subtraction.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one step on the addition and subtraction of decimal numbers.

COMMON MISCONCEPTIONS AND ERRORS

Students may be confused about how to align digits when subtracting decimal numbers.



ACCESS (10 min)



Fishing in the Nile Valley: Error Analysis

Work with students to read the passage. Then, have students work independently to complete the error analysis. Discuss the answers together.

Answer Key for Fishing in the Nile Valley: Error Analysis

1. Wafaa knew she had to stack the numbers. She regrouped the digits correctly based on how she lined them up.
2. Wafaa did not line up the numbers correctly. She did not understand that she must add similar place values together.
3. 151.49 kg

BUILD (40 min)





Model Subtraction (30 min)

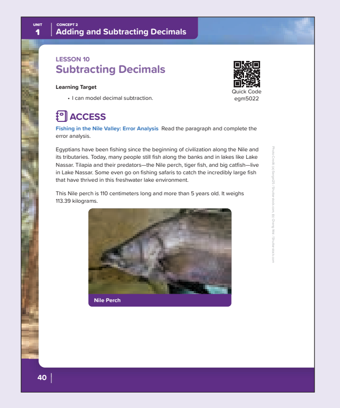
1. Explain that Problem 1 represents a shaded decimal number that is the minuend. The *x*'s represent a decimal number subtrahend, the number that is subtracted from the minuend. Ask students to complete Problem 1.
2. Call on students to share their equations and answers and explain their thinking with the class. Ask questions to promote discussion, such as:



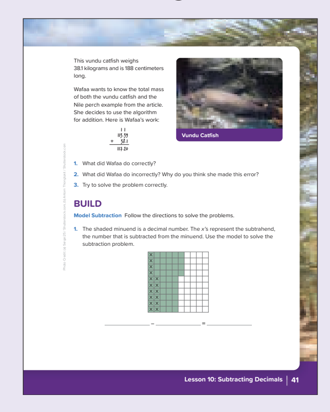
- *How does the model help you solve the problem? This model shows a visual representation of the original decimal number and the number being taken away.*
- *Does this problem involve regrouping? Yes, this problem requires that 0.54 is regrouped so that a 10 is regrouped from the Tenths place and 0.16 can be subtracted.*

3. Ask students to solve Problem 2 and compare their model with their partner's model. Ask volunteers to share their observations.
4. Direct students to work independently to complete Problems 3–7. Review all answers with students.

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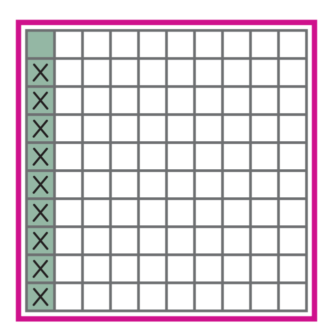
Student Page 41



Answer Key for Model Subtraction

1. 0.54 – 0.16 = 0.38

Whiteboard: 2.

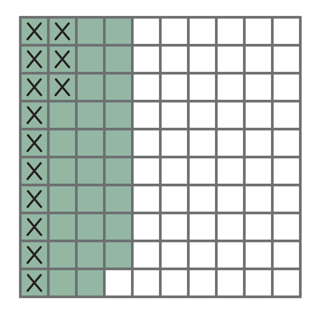


0.1 – 0.09 = 0.01

3. 0.57 – 0.28 = 0.29

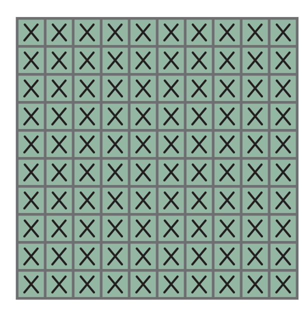
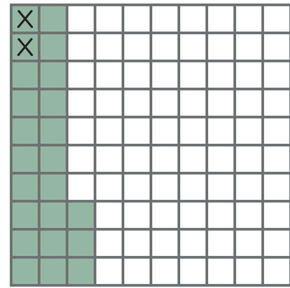
4. 1.22 – 0.27 = 0.95

Whiteboard: 5. Accept all accurate models. Example:



0.26

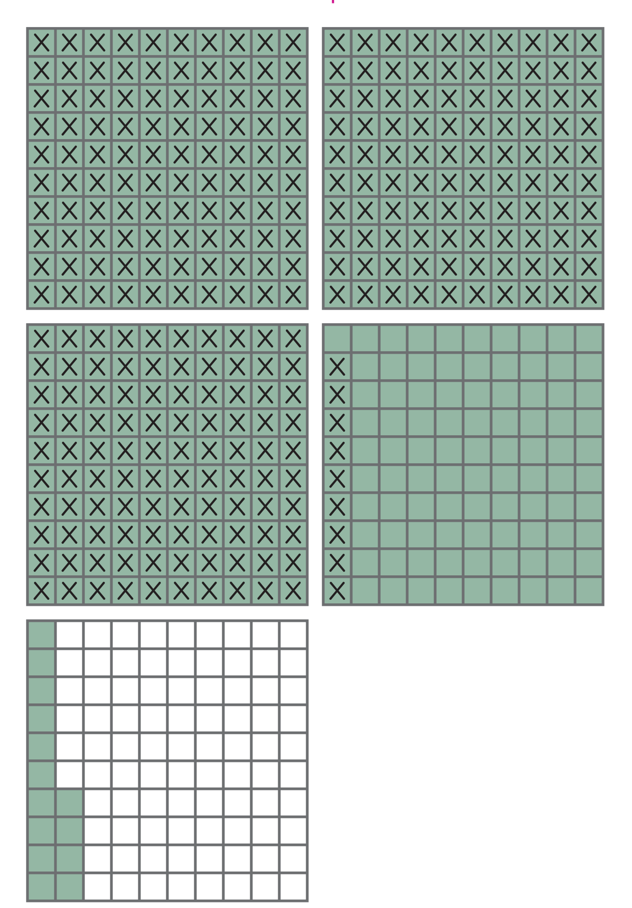
Whiteboard: 6. Accept all accurate models. Example:

0.21



Whiteboard: 7. Accept all accurate models. Example:



1.05

Algorithm Connection (10 min)

1. Ask students to solve Problems 1 and 2 and then explain how the model helps them solve the problem. The model shows both Tenths and Hundredths. They turn 2 Tenths into 20 Hundredths in order to subtract 5 Hundredths.

2. Next, draw the place value chart on the board and ask students how the place value chart helps them solve the problem. The place value chart shows how to line up the numbers as a subtraction problem.

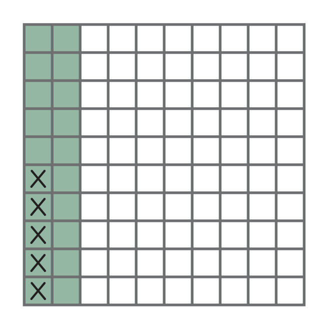
3. Discuss the importance of having the same number of digits in each place value. Ask students to think about what digit they could put in the Hundredths place that would not change the value of the number. Use Calling Sticks to select students to share their thinking. Adding zeros to the right of the last decimal digit does not change its value. By adding a 0 to the Hundredths place we can use the standard algorithm to solve the problem, since both numbers have the same number of decimal places.

4. Ask volunteers to help you record the problem on the board and subtract to find the answer. Encourage students to refer back to the model they made to see the relationship.

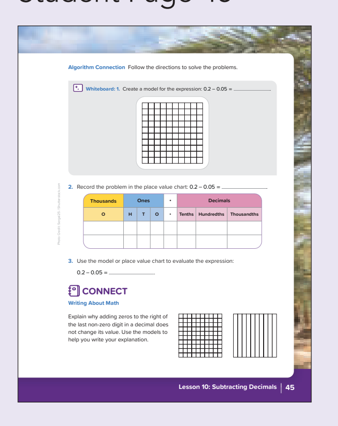
Ones		•	Decimals		
T	O	•	Tenths	Hundredths	Thousandths
	0	•	~~2~~ 1	~~0~~ 10	
	0	•	0	5	

Answer Key for Algorithm Connection

Whiteboard: 1.



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2.

Ones		•	Decimals		
T	O	•	Tenths	Hundredths	Thousandths
	0	•	2	0	
	0	•	0	5	

3. 0.2 – 0.05 = 0.15





Writing About Math

Ask students to respond to the prompt. After a few minutes of independent writing, ask students to share their answers and explain their thinking.

Answer Key for Writing About Math

Adding a zero to the end of a decimal number does not change its value because the zero does not change the place value of any other digits in the number.

Writing About Math
Teacher Note:

If students struggle to understand this concept, use a meterstick to show them how 3 meters is equivalent to 300 centimeters and 3,000 millimeters. It is still the same numerical value even though the unit changes. Students learned how to find equivalent decimal fractions in Primary 4, so reviewing that work will further build conceptual understanding.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to reflect on today's Learning Target. Call on students to share their thinking related to the following questions:

- What strategy helps you subtract decimals?
- What is still challenging?
- How is subtracting decimals similar to and different from adding them?

PRACTICE

1. 0.95 (or .95)
2. 0.31 (or .31)
3. 2.83
4. 1.05
5. 0.11 (or .11)

DIGITAL



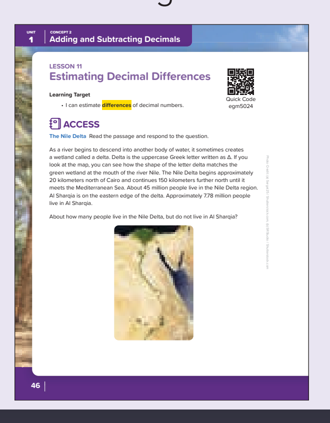
Quick Code:
egmt5024

VIDEO LESSON



Quick Code:
egmt5025

Student Page 46



LESSON 11
Estimating Decimal Differences

Lesson Overview

In this lesson, students combine their understanding of rounding decimals to given place values, use rounded numbers to find the difference in decimal equations, and practice regrouping decimal numbers. The BUILD section allows students to use all of these skills and apply them to solve problems.

Lesson Essential Questions

- Why do mathematicians estimate?
- How do mathematicians estimate?
- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objective

- Students will estimate differences of decimal numbers.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one step on the addition and subtraction of decimal numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to flexibly use strategies for estimation.
- Students may struggle to identify why estimating is helpful both before and after solving a problem.

ACCESS (10 min) 

The Nile Delta

Work with students to read the passage. Then, ask students to work independently to answer the question. Encourage students to use mental math to estimate. After a few minutes, ask students to share their estimates and estimation strategies.

Answer Key for The Nile Delta

About 37 or 38 million people.

BUILD (40 min) 

A Closer Look at Close Numbers (30 min)

1. Ask students to discuss the strategies and methods they used to estimate when they added decimals. Ask students to explain whether estimating subtraction answers is different from estimating addition answers.
2. Divide your class into four groups. Assign each group one of the following estimation strategies: front-end estimation, rounding to Tenths, rounding to Hundredths, benchmark decimals. Provide time for each group to use their assigned strategy to estimate the differences for Problem 1.
3. Have each group share their estimates with the class. Ask students to discuss what they noticed about the different estimates. Ask students to predict what will happen if they repeat the process for Problem 2.
4. Repeat for Problem 2. Then, solve both problems on the board and ask students to identify which strategies gave the most accurate estimates.
5. Direct students to complete Problems 3 through 10. Encourage students to use the estimation strategies that give the most accurate estimates.
6. Use the last few minutes of BUILD to check answers as a class. Ask students to Popcorn to each other to call out the answers. If necessary, model them on the board using a place value chart or a decimal model.

Answer Key for A Closer Look at Close Numbers

1. Estimate should be between 1 and 1.2.
2. Estimate should be between 20 and 25.
3. Estimate should be between 10 and 20.
4. 17.99
5. Estimate should be between 0.1 and 1.
6. 0.15
7. Estimate should be between 0.9 and 1.
8. 0.9
9. Estimate should be between 0 and 0.1.
10. 0.13

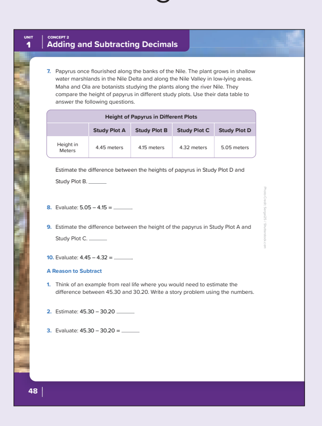
A Reason to Subtract (10 min)

If time allows, ask students to write and solve a story problem for 45.30 – 30.20. Students should then estimate the solution and calculate the difference. Ask volunteers to share their story problems.

A Closer Look at Close Numbers
Teacher Note for #6:

BUILD focuses on giving students time to solve problems independently. They practice both rounding and regrouping, reiterating the Learning Targets from Lessons 8 and 10. Both of these skills require balancing time spent solving problems and giving students a chance to ask any questions and clear up misconceptions.

Student Page 48



UNIT 1 | CONCEPT 2
Adding and Subtracting Decimals

7. Papyrus once flourished along the banks of the Nile. The plant grows in shallow water marshlands in the Nile Delta and along the Nile Valley in low-lying areas. Maha and Ola are botanists studying the plants along the river Nile. They compare the height of papyrus in different study plots. Use their data table to answer the following questions.

Height of Papyrus in Different Plots				
	Study Plot A	Study Plot B	Study Plot C	Study Plot D
Height in Meters	4.45 meters	4.15 meters	4.32 meters	5.05 meters

Estimate the difference between the heights of papyrus in Study Plot D and Study Plot B. ______

8. Evaluate: 5.05 – 4.15 = ______

9. Estimate the difference between the height of the papyrus in Study Plot A and Study Plot C. ______

10. Evaluate: 4.45 – 4.32 = ______

A Reason to Subtract

1. Think of an example from real life where you would need to estimate the difference between 45.30 and 30.20. Write a story problem using the numbers.

2. Estimate: 45.30 – 30.20 ______

3. Evaluate: 45.30 – 30.20 = ______

Photo Credit: SergeIQ5 / Shutterstock.com

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Answer Key for A Reason to Subtract

1. Story problems will vary.
2. Estimate should be between 10 and 15.1.
3. 15.10



CONNECT (7 min)



Math around Egypt: Abu Simbel

Work with students to read the passage, and then ask them to answer the questions. Use Calling Sticks to choose students to share their answers with the class.

Answer Key for Math around Egypt: Abu Simbel

1. B
2. 9 meters

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to use a Fist-to-Five to show their understanding of estimating decimal differences. Give students a moment to explain what they feel good about and what they still need to work on.

PRACTICE

1. 5 – 3 = 2
2. 5.4 – 3.3 = 2.1
3. 5.36 – 3.27 = 2.09
4. 2.091
5. 2.09 is the closest estimate because it was rounded to the lowest place value.

LESSON 12
Subtracting to the Thousandths Place

Lesson Overview

In this lesson, students connect the ways they determined reasonableness of a sum in Lesson 9 with finding a difference in subtraction. Students compare subtraction and addition of decimals and discuss strategies to find the difference between decimals to the Thousandths place.

Lesson Essential Questions

- Why do mathematicians estimate?
- How do mathematicians estimate?
- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objectives

- Students will apply strategies to subtract decimals to the Thousandths place.
- Students will check the reasonableness of their answers.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one step on the addition and subtraction of decimal numbers.

COMMON MISCONCEPTIONS AND ERRORS

Students may not understand that they can add a zero to the end of a decimal number to aid in subtraction.



ACCESS (10 min)



A Deeper Dive into Deltas

Remind students that in Lesson 11 they learned that the Nile forms a delta where it meets the Mediterranean Sea. Work with students to read the passage, and then ask students to answer to the questions. Call on students to discuss whether Diaa's answer is reasonable and why.

DIGITAL



Quick Code: egmt5026

Materials List

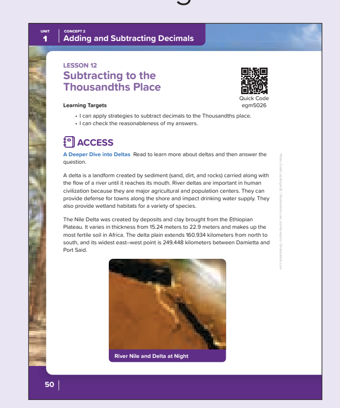
- Decimal Spinners from Lesson 9

VIDEO LESSON

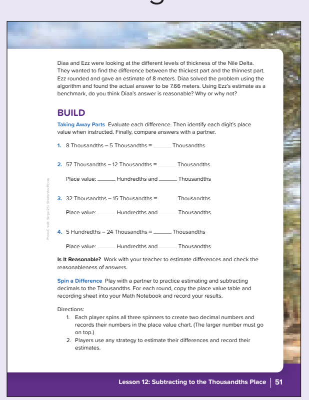


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Student Page 50



Student Page 51



Diaa and Ezz were looking at the different levels of thickness of the Nile Delta. They wanted to find the difference between the thickest part and the thinnest part. Ezz rounded and gave an estimate of 8 meters. Diaa solved the problem using the algorithm and found the actual answer to be 7.66 meters. Using Ezz's estimate as a benchmark, do you think Diaa's answer is reasonable? Why or why not?

BUILD

Taking Away Parts Evaluate each difference. Then identify each digit's place value when instructed. Finally, compare answers with a partner.

1. 8 Thousandths – 5 Thousandths = ______ Thousandths

2. 57 Thousandths – 12 Thousandths = ______ Thousandths

Place value: ______ Hundredths and ______ Thousandths

3. 32 Thousandths – 15 Thousandths = ______ Thousandths

Place value: ______ Hundredths and ______ Thousandths

4. 5 Hundredths – 24 Thousandths = ______ Thousandths

Place value: ______ Hundredths and ______ Thousandths

Is It Reasonable? Work with your teacher to estimate differences and check the reasonableness of answers.

Spin a Difference Play with a partner to practice estimating and subtracting decimals to the Thousandths. For each round, copy the place value table and recording sheet into your Math Notebook and record your results.

Directions:
1. Each player spins all three spinners to create two decimal numbers and records their numbers in the place value chart. (The larger number must go on top.)
2. Players use any strategy to estimate their differences and record their estimates.

Photo Credit: Sergei25 / Shutterstock.com

Lesson 12: Subtracting to the Thousandths Place | 51

Answer Key for A Deeper Dive into Deltas

Yes, Diaa's answer is reasonable because 7.66 rounded to the nearest whole number is 8.

BUILD (40 min) 

Taking Away Parts (20 min)

1. Review regrouping by asking students to explain how to regroup Tenths into Hundredths and Hundredths into Thousandths.

2. Ask students to complete the Problems 1–4, and then share their answers with a partner. Call on volunteers to model their solutions on the board. Allow students to use place value charts and to help each other regroup, if needed.

Answer Key for Taking Away Parts

1. 3 Thousandths
2. 45 Thousandths; 4 Hundredths and 5 Thousandths
3. 17 Thousandths; 1 Hundredth and 7 Thousandths
4. 26 Thousandths; 2 Hundredths and 6 Thousandths

Is It Reasonable? (20 min)

1. Review with students what it means to check the reasonableness of their answers. Encourage students to use examples.

2. Write 3.5 – 1.27 = _____ on the board and ask students to read the problem aloud. Ask students:



- *How many decimal places does the first number have?* 1
- *How many decimal places does the second number have?* 2
- *If you wanted both decimals to have the same number of places, what would you do?* Add a zero to 3.5 to make it 3.50.
- *Now that both decimals have the same number of places, if you subtract them, how many decimal places will there be in the difference?* 2
- *Will you need to regroup?* Yes

3. Direct students to estimate the difference to help check the reasonableness of their actual answer. (They can estimate any way they choose.) Ask students to share their estimates and decide which strategy provides the best estimate. Estimates should be between 2 and 3; 3.5 – 1.3 = 2.2

4. Ask students to find the actual answer and determine whether or not their estimates help them check the reasonableness of their answer.

5. Repeat for 153.54 – 28.418. Estimates should be between 80 and 126; 153.54 – 28.418 = 125.122

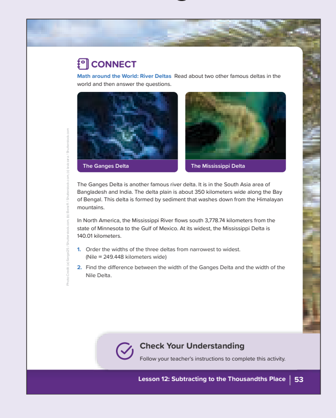
Spin a Difference (optional)

If time permits, go over the directions for Spin a Difference and allow students to play until the end of BUILD.

Answer Key for Spin a Difference

Recorded decimals, estimations, differences, partner differences, and comparisons will vary.

Student Page 53





CONNECT (7 min)

Math around the World: River Deltas

Work with students to read the passage. Then, have them solve the problems. Ask students to share their answers and explain their thinking.

Answer Key for Math around the World: River Deltas

1. 140.01, 249.448, 350 or Mississippi, Nile, Ganges
2. 350 – 249.448 = 100.552 km

WRAP-UP (3 min)



Let's Chat About Our Learning

Invite students to think about today's learning and how it relates to how and why mathematicians estimate. Allow time for students to explain their thinking with the class.
Estimation can help to check the reasonableness of actual answers. Depending on how you round each addend will determine how close to the actual answer you can get. Estimating before calculating gives you an idea what the answer will be.

PRACTICE

1. 11.247
2. A
3. 13.2
4. 13.23
5. 46.662

DIGITAL



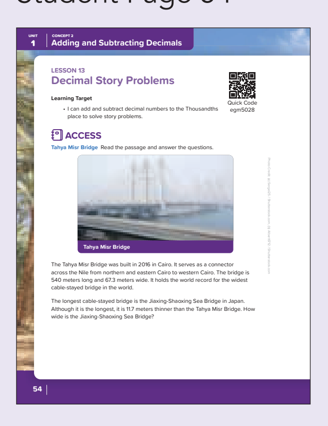
Quick Code:
egmt5028

VIDEO LESSON



Quick Code:
egmt5029

Student Page 54



UNIT 1 | CONCEPT 2
Adding and Subtracting Decimals

LESSON 13
Decimal Story Problems

Quick Code
egm5028

Learning Target

- I can add and subtract decimal numbers to the Thousandths place to solve story problems.

ACCESS

Tahya Misr Bridge Read the passage and answer the questions.

Tahya Misr Bridge

The Tahya Misr Bridge was built in 2016 in Cairo. It serves as a connector across the Nile from northern and eastern Cairo to western Cairo. The bridge is 540 meters long and 67.3 meters wide. It holds the world record for the widest cable-stayed bridge in the world.

The longest cable-stayed bridge is the Jiaxing-Shaoxing Sea Bridge in Japan. Although it is the longest, it is 11.7 meters thinner than the Tahya Misr Bridge. How wide is the Jiaxing-Shaoxing Sea Bridge?

54

LESSON 13
Decimal Story Problems

Lesson Overview

In this lesson, students add and subtract decimals to the Thousandths place to solve real-world story problems. They are challenged to consider the problem carefully in order to choose an effective problem-solving strategy. They also estimate to check the reasonableness of their answers.

Lesson Essential Questions

- Why do mathematicians estimate?
- How do mathematicians estimate?
- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objective

- Students will add and subtract decimal numbers to the Thousandths place to solve story problems.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one-step on the addition and subtraction of decimal numbers.

> COMMON MISCONCEPTIONS AND ERRORS
>
> Students may struggle to understand whether a story problem involves addition or subtraction.



ACCESS (10 min)



Tahya Misr Bridge

Work with students to read the passage, and then ask students to work independently to solve the problem. Call on volunteers to share their answers, write them on the board, and explain how they solved the problem.

Answer Key for Tahya Misr Bridge

67.3 – 11.7 = 55.6 meters

BUILD (40 min)  

Bridges and Fish (15 min)

1. Explain to students that the reason we learn mathematics is to make us better thinkers and better communicators and to solve problems in our everyday lives. In this lesson, students apply what they have learned in the unit to solve story problems.

2. Ask students to read the two problems and discuss with a partner what the problems are asking. (Students should not solve the problems yet.)

3. Discuss the following questions:



- *In the first problem do you need all three numbers listed? No, the 200 cranes are not necessary.*
- *How do you determine what numbers are necessary to solve a story problem? Answers may include reading carefully and thinking about what is being asked.*
- *Is there more than one way to solve these problems? Yes. Some may use addition to solve the first problem, adding-up from 6.44 to 544.3, and others may use subtraction to find the difference.*
- *What equation could we write to solve the first problem? 544.3 – 6.44 = _____ or 6.44 + _____ = 544.3.*
- *If you wanted to change the second problem into a subtraction problem, what question could you ask? Answers may include, "What is the difference between the heaviest and the lightest fish?" or "How much heavier was the big fish?"*

4. Ask students to work with a partner to solve Problems 1 and 2. Call on volunteers to share their answers and explain their solution strategies.

Answer Key for Bridges and Fish

Accept all equations that yield the correct answer.

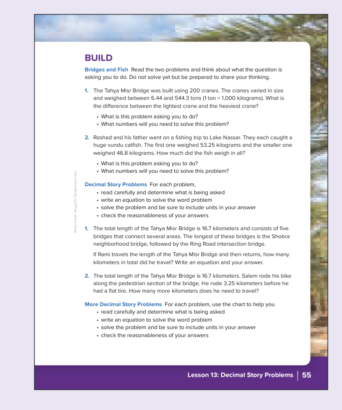
1. 544.3 – 6.44 = 537.86 tons
2. 53.25 + 46.8 = 100.05 kg

Decimal Story Problems, More Decimal Story Problems (25 min)

1. Direct students to work independently to solve the problems. For each problem, students must record an equation and an answer.

2. Go over the answers with the class, discuss problem-solving strategies, and clear up misconceptions and errors.

Student Page 55



BUILD

Bridges and Fish Read the two problems and think about what the question is asking you to do. Do not solve yet but be prepared to share your thinking.

1. The Tahya Misr Bridge was built using 200 cranes. The cranes varied in size and weighed between 6.44 and 544.3 tons (1 ton = 1,000 kilograms). What is the difference between the lightest crane and the heaviest crane?
   - What is this problem asking you to do?
   - What numbers will you need to solve this problem?
2. Rashad and his father went on a fishing trip to Lake Nassar. They each caught a huge vundu catfish. The first one weighed 53.25 kilograms and the smaller one weighed 46.8 kilograms. How much did the fish weigh in all?
   - What is this problem asking you to do?
   - What numbers will you need to solve this problem?

Decimal Story Problems For each problem,
- read carefully and determine what is being asked
- write an equation to solve the word problem
- solve the problem and be sure to include units in your answer
- check the reasonableness of your answers

1. The total length of the Tahya Misr Bridge is 16.7 kilometers and consists of five bridges that connect several areas. The longest of these bridges is the Shobra neighborhood bridge, followed by the Ring Road intersection bridge.

   If Rami travels the length of the Tahya Misr Bridge and then returns, how many kilometers in total did he travel? Write an equation and your answer.
2. The total length of the Tahya Misr Bridge is 16.7 kilometers. Salem rode his bike along the pedestrian section of the bridge. He rode 3.25 kilometers before he had a flat tire. How many more kilometers does he need to travel?

More Decimal Story Problems For each problem, use the chart to help you
- read carefully and determine what is being asked
- write an equation to solve the word problem
- solve the problem and be sure to include units in your answer
- check the reasonableness of your answers

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Lesson 13: Decimal Story Problems | 55

Decimal Story Problems, More Decimal Story Problems
Teacher Note for #2:

Story problems require a strong reading ability, so if a student is struggling to read the text, partner them with a more proficient reader. Students may use a variety of strategies to solve these problems. Accept all effective and efficient strategies and allow for time for students to explain and teach their strategy to the group.

Answer Key for Decimal Story Problems

Accept all equations that yield the correct answer.

1. 16.7 + 16.7 = 33.4 km or 16.7 × 2 = 33.4 km
2. 16.7 – 3.25 = 13.45 km or 3.25 + 13.45 = 16.27 km

Answer Key for More Decimal Story Problems

Accept all equations that yield the correct answer.

1. 104.902 + 104.902 + 201.168 = 410.972 cm
2. 201.168 – 30.2 = 170.968 cm or 30.2 + 170.968 cm = 201.168 cm
3. 35.17 – 29.255 = 5.915 cm or 29.255 + 5.915 = 35.17 cm

Student Page 56



CONNECT (7 min)



Math around the World: Famous Bridges

Direct students to use the information in the chart to write a story problem. Then, ask students to swap problems with a partner and solve. Call on volunteers to share their story problem and their partner's solution.

Answer Key for Math around the World: Famous Bridges

Story problems and answers will vary.

WRAP-UP (3 min)



Let's Chat About Our Learning

Invite students to reflect on today's learning and how it relates to the unit's Essential Question: *How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?* Allow time for students to explain their thinking with the class.

Answers will vary, but some examples include finding the total cost of groceries; determining accurate distances; measuring length, mass, and capacity; analyzing sports statistics; or calculating the difference in petrol prices.

PRACTICE

Accept all correct versions of the decimal answers.

1. 0.902 kg
2. 5.3 km (or 5.30 km)
3. 0.37 m (or 0.370 m)
4. 3.25 km (or 3.250 km, 3.25 kilometers)
5. 4.25 km (or 4.250 km, 4.25 kilometers, 4.250 kilometers)

Challenge 4.02 L (or 4.02 liters, 4.020 L, 4.020 liters)

DIGITAL



Quick Code: egmt5030

CONCEPT CHECK-IN AND REMEDIATION
Adding and Subtracting Decimals

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Adding and Subtracting Decimals. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed in the chart, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- Why do mathematicians estimate?
- How do mathematicians estimate?
- How do you use addition and subtraction of whole numbers and decimals to help you solve problems in everyday life?

Lesson Learning Objective

- Students will correct their misconceptions and errors related to decimal addition and subtraction.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve word problems of one step on the addition and subtraction of decimal numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to estimate with mixed numbers because they do not see them as parts and wholes.
- Students may not pay attention to place value when adding decimal numbers with different amounts of digits.
- Students may struggle to round decimal numbers in order to estimate.
- Students may not understand that, when adding decimals, if the addend has numbers to the Hundredths place, the sum may have numbers in the Hundredths place, but never the Thousandths place.
- Students may be confused about how to align digits when subtracting decimal numbers.
- Students may struggle to flexibly use strategies for estimation.
- Students may struggle to identify why estimating is helpful both before and after solving a problem.
- Students may not understand that they can add a zero to the end of a decimal number to aid in subtraction.
- Students may struggle to understand whether a story problem involves addition or subtraction.

Remediation: Correcting Misconceptions

If . . . Students struggle when estimating numbers to round decimals to appropriate place value.	**Then . . .** Review Lesson 7. Give students decimal numbers to practice rounding and review the Rounding Rule Poster from Lesson 6.
If . . . Students do not pay attention to place value when adding decimal numbers with different amounts of digits.	**Then . . .** Review Lesson 8. Have students build a variety of models for Tenths and Hundredths and practice adding them. Use place value charts to help students practice lining up decimals when adding numbers to keep place values the same.
If . . . Students do not understand how to subtract decimal numbers when they do not have the same number of decimal places.	**Then . . .** Review Lesson 10. Give students additional practice problems similar to those in this lesson. Students can also use models to help them solve problems subtracting a number that ends in a Hundredth from a number that ends in a Tenth.
If . . . Students do not understand that, when adding decimals, if the addend has Hundredths, the sum will also have Hundredths but never Thousandths.	**Then . . .** Review Lesson 9 and provide students with a variety of problems to solve and discuss so that they can come to an understanding that when adding decimal numbers, the digits to the left of the smallest place value will change, not the right.
If . . . Students do not understand that they can add a zero to the end of a decimal number to aid in subtraction.	**Then . . .** Review Lesson 12 and have students use models to review how 0.5 can also be represented as 0.50. If necessary, review decimal equivalence.

If . . .	Then . . .
Students struggle to understand whether a story problem is addition or subtraction.	Review the first part of BUILD in Lesson 13 where students are reading story problems and discussing what is being asked. Practice with a variety of story problems, having students read them carefully, draw pictures, or discuss what is happening, and then think about strategies to solve.

UNIT
2
NUMBER RELATIONSHIPS

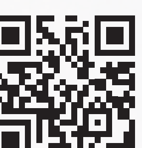
Theme 1 | Number Sense and Operations

ESSENTIAL QUESTIONS

- How can operational relationships help you solve for a variable?
- How do numbers tell stories?
- What relationships are revealed by breaking numbers into their factors?
- How are all numbers related through factors and multiples?

Photo Credit: Mountains Hunter / Shutterstock.com

Video Questions



Quick Code
egmt5031

The Unit 2 Opener Video, Grand Egyptian Multiples, explores math around Egypt through number relationships. In this unit, students learn how numbers tell stories about the world around them through expressions and equations. They also explore relationships between factors and multiples.

- How did the students use number relationships to make sense of the world around them?
- What did the students find out about factors and multiples?





Quick Code
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As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

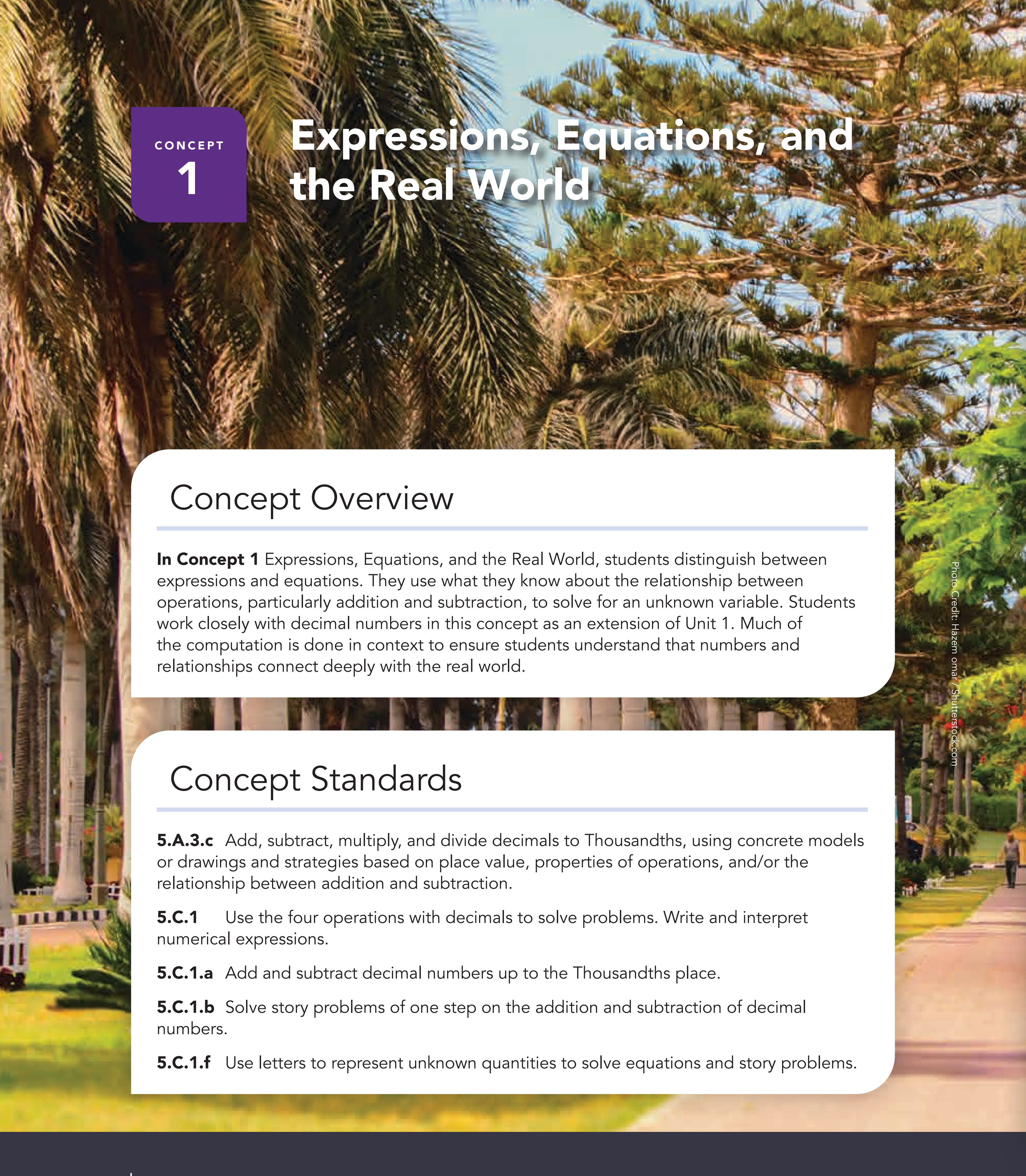
addend, common factors, Commutative Property of Addition, composite, difference, divisor, equation, expression, factor, factor pair, factor tree, finite, greatest common factor (GCF), infinite, inverse operation, irregular polygon, least common multiple (LCM), multiple, perimeter, prime, prime factorization, prime number, product, unknown, variable

Photo Credit: Mountains Hunter / Shutterstock.com

Mathematical Background Knowledge

Unit Background

In this unit, students analyze relationships between numbers as they continue learning about the geography of Egypt. They look at operational relationships as well as how numbers decompose and compose. Bridging from Unit 1's focus on the place value system and decimal numbers in particular, the first half of Unit 2 examines decimal numbers in equations and expressions. Students use what they know about the relationship between operations to find unknown quantities. In the second half of Unit 2, students launch into a deeper study of multiples and factors. This conceptual understanding began in Primary 4 and extends in Primary 5 as students see factors as the building blocks of numbers and multiples as the extension of numbers.



CONCEPT 1

Expressions, Equations, and the Real World

Concept Overview

In Concept 1 Expressions, Equations, and the Real World, students distinguish between expressions and equations. They use what they know about the relationship between operations, particularly addition and subtraction, to solve for an unknown variable. Students work closely with decimal numbers in this concept as an extension of Unit 1. Much of the computation is done in context to ensure students understand that numbers and relationships connect deeply with the real world.

Concept Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve story problems of one step on the addition and subtraction of decimal numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

LESSON 1
Expressions, Equations, and Variables

Lesson Overview

In this lesson, students explore the meaning of equations, expressions, and variables. They compare expressions and equations and discuss what a variable represents in a given equation.

Lesson Essential Questions

- How can operational relationships help you solve for a variable?
- How do numbers tell stories?

Lesson Learning Objectives

- Students will explain the difference between expressions and equations.
- Students will explain why there might be an unknown in an expression or equation.
- Students will use letters or symbols to represent unknowns in expressions and equations.

Grade-Level Standards

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

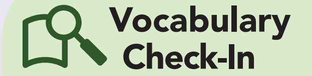
COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that the equal sign indicates balance. Both sides of the equal sign have the same value.
- Students may not understand that the variable represents the unknown quantity in an equation or expression and that it does not matter what letter or symbol is used.

DIGITAL



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Vocabulary Check-In

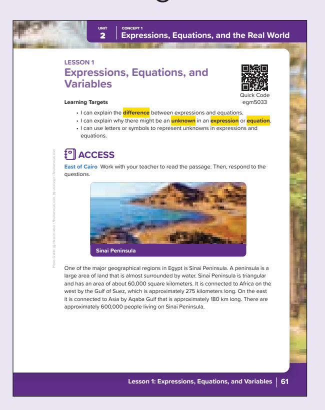
equation, expression, variable, unknown

VIDEO LESSON



Quick Code: egmt5034

Student Page 61


UNIT 2 | CONCEPT 1 Expressions, Equations, and the Real World

LESSON 1
Expressions, Equations, and Variables

Quick Code egm5033

Learning Targets
- I can explain the difference between expressions and equations.
- I can explain why there might be an unknown in an expression or equation.
- I can use letters or symbols to represent unknowns in expressions and equations.

ACCESS

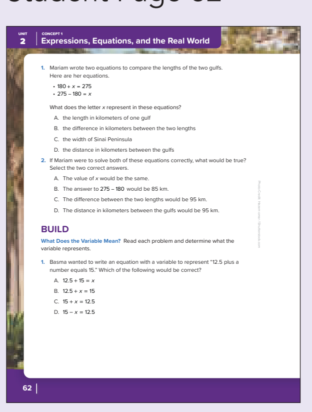
East of Cairo Work with your teacher to read the passage. Then, respond to the questions.

Sinai Peninsula

One of the major geographical regions in Egypt is Sinai Peninsula. A peninsula is a large area of land that is almost surrounded by water. Sinai Peninsula is triangular and has an area of about 60,000 square kilometers. It is connected to Africa on the west by the Gulf of Suez, which is approximately 275 kilometers long. On the east it is connected to Asia by Aqaba Gulf that is approximately 180 km long. There are approximately 600,000 people living on Sinai Peninsula.

Lesson 1: Expressions, Equations, and Variables | 61

Student Page 62


UNIT 2 | CONCEPT 1 Expressions, Equations, and the Real World

1. Mariam wrote two equations to compare the lengths of the two gulfs. Here are her equations.
   - $180 + x = 275$
   - $275 - 180 = x$

   What does the letter x represent in these equations?
   A. the length in kilometers of one gulf
   B. the difference in kilometers between the two lengths
   C. the width of Sinai Peninsula
   D. the distance in kilometers between the gulfs
2. If Mariam were to solve both of these equations correctly, what would be true? Select the two correct answers.
   A. The value of x would be the same.
   B. The answer to $275 - 180$ would be 85 km.
   C. The difference between the two lengths would be 95 km.
   D. The distance in kilometers between the gulfs would be 95 km.

BUILD

What Does the Variable Mean? Read each problem and determine what the variable represents.

1. Basma wanted to write an equation with a variable to represent "12.5 plus a number equals 15." Which of the following would be correct?
   A. $12.5 + 15 = x$
   B. $12.5 + x = 15$
   C. $15 + x = 12.5$
   D. $15 - x = 12.5$

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ACCESS (10 min)

East of Cairo

Work with students to read the passage. Then, ask students to answer the questions. Review the answers together.

Answer Key for East of Cairo

1. B. the difference in kilometers between the two lengths
2. A. The value of x would be the same; C. The difference between the two lengths would be 95 km.

BUILD (40 min)




What Does the Variable Mean? (20 min)

1. Write the word *variable* on the board and ask students to share what they think or remember about the definition. Reinforce that mathematicians often use a letter or a symbol to represent an unknown quantity in an equation. They call the letter or symbol a variable. Refer to the ACCESS problem as needed to build students' understanding.
2. Direct students to solve Problems 1 through 5. Go over the answers together. Emphasize that the variable in each problem represents the unknown quantity that is being solved. In Problem 3, discuss how the equations in both A and C can find the missing dune height. Use Problem 4 to review the Commutative Property of Addition.

Answer Key for What Does the Variable Mean?

1. B. $12.5 + x = 15$
2. C. the difference between the tallest and shortest sand dunes
3. A. $18.25 + x = 46$; C. $46 - 18.25 = x$
4. B. the sum of the heights of both dunes

Equations and Expressions (10 min)

1. Work with students to compare the problems.
2. Explain the difference between expressions and equations to students. Use the glossary and examples to build understanding. Ask students if the problems in the first part of BUILD were equations or expressions.

Answer Key for Equations and Expressions

Accept all reasonable observations.

Equation or Expression? (10 min)

1. Ask students to sort the mathematical statements into Equations, Expressions, or Neither.
2. After a few minutes, review the task by asking



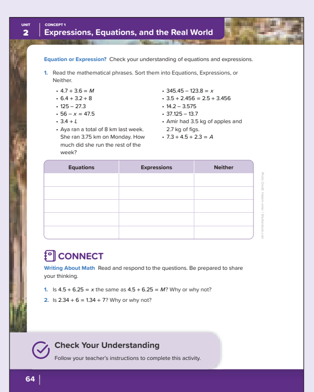
- *How did you decide to sort? Students should recognize that expressions do not have equal signs.*
- *What did you do with the Aya and Amir items? Students should sort them into Neither.*
- *How could we turn the Aya and Amir items into equations? Answers will vary. Aya problem examples:* $3.75 + x = 8$ *or* $8 - 3.75 = x$. *Amir problem: Ask what question might be asked and what equation could represent it. Examples:* $3.5 + 2.7 = x$ *or* $3.5 - 2.7 = x$.
- *Could the expressions be made into equations? How? Yes. Add an equal sign and a variable for the unknown sums and differences.*
- *Why would mathematicians use an expression? To represent a numerical situation.*

3. If time permits, ask students to solve the five equations with a partner on a separate sheet of paper. $M = 8.3$; $x = 8.5$; $x = 221.65$; $5.956 = 5.956$; $A = 14.1$

Answer Key for Equation or Expression?

Equations	Expressions	Neither
$4.7 + 3.6 = M$	$6.4 + 3.2 + 8$	Aya ran a total of 8 km last week. She ran 3.75 km on Monday. How much did she run the rest of the week?
$56 - x = 47.5$	$125 - 27.3$	Amir had 3.5 kg of apples and 2.7 kg of figs.
$345.45 - 123.8 = x$	$3.4 + L$	
$3.5 + 2.456 = 2.5 + 3.456$	$14.2 - 3.575$	
$7.3 + 4.5 + 2.3 = A$	$37.125 - 13.7$	

Student Page 64





CONNECT (7 min)



Writing About Math

Ask students to respond to the prompt. After a few minutes of independent writing, ask students to share their answers and explain their thinking. Clarify misconceptions.

Answer Key for Writing About Math

1. The two equations are the same even though they use different letters as a variable.
2. Both sides of the equation have a value of 8.34 and therefore are equivalent.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to work with their Shoulder Partner to define the terms *equation*, *expression*, and *variable* in their own words. Use Calling Sticks to select partners to share their definitions with the class.

PRACTICE

1. C. $2.64 - 2.07 = H$
2. A. 0.57 km
3. True
4. B. *H* represents the total kilometers hiked.
5. 6.99 km



LESSON 2
Variables in Equations

Lesson Overview

In this lesson, students are challenged to see the relationship between numbers in an equation and how to use that relationship to solve for a variable. Students begin with a Number Talk to find a missing variable in whole number equations. They use this foundation to solve similar problems with decimals and then work to solve for unknowns in addition and subtraction decimal equations.

Lesson Essential Questions

- How can operational relationships help you solve for a variable?
- How do numbers tell stories?

Lesson Learning Objective

- Students will apply the relationship between addition and subtraction to find the value of the unknown in an equation.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve story problems of one step on the addition and subtraction of decimal numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

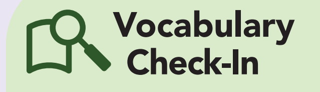
COMMON MISCONCEPTIONS AND ERRORS

Students may struggle to use the inverse operation to solve for a variable.

DIGITAL



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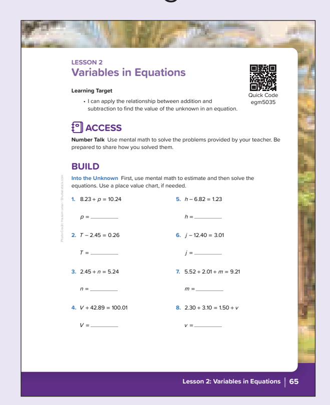
inverse operation

VIDEO LESSON



Quick Code: egmt5036

Student Page 65


LESSON 2
Variables in Equations

Learning Target
- I can apply the relationship between addition and subtraction to find the value of the unknown in an equation.

Quick Code egm5035

ACCESS

Number Talk Use mental math to solve the problems provided by your teacher. Be prepared to share how you solved them.

BUILD

Into the Unknown First, use mental math to estimate and then solve the equations. Use a place value chart, if needed.

1. $8.23 + p = 10.24$ $p =$ ______
2. $T - 2.45 = 0.26$ $T =$ ______
3. $2.45 + n = 5.24$ $n =$ ______
4. $V + 42.89 = 100.01$ $V =$ ______
5. $h - 6.82 = 1.23$ $h =$ ______
6. $j - 12.40 = 3.01$ $j =$ ______
7. $5.52 + 2.01 + m = 9.21$ $m =$ ______
8. $2.30 + 3.10 = 1.50 + v$ $v =$ ______

Photo Credit: Hazem omar / Shutterstock.com

Lesson 2: Variables in Equations | 65

Number Talk
Teacher Note for #1:

Students can also write their answers on an erasable whiteboard and show their responses rather than giving a Thumbs Up to share. This strategy allows all students to respond and for you to quickly see what students know.

Number Talk
Teacher Note for #2:

This Number Talk provides students examples of how they can use what they know about whole numbers to solve decimal equations. It also encourages them to be flexible when solving problems with variables. The last problem reminds students that an equation can have more than one number on each side of the equal sign.

ACCESS (10 min)

Number Talk

1. Number Talk directions are as follows:
   - The teacher writes problem on board.
   - Students think quietly and give a Thumbs Up when they know the answer.
   - The teacher gives Wait Time while students think about the problem.
   - Call on several students who have their thumbs up and record their answers on the board.
   - Ask volunteers to explain their thinking.
   - Record their thinking on the board so other students can see their strategies.
2. Work through as many problems in the following sequence as time allows:
   - $5 + x = 10$; $0.5 + x = 1$ 5; 0.5
   - $x + 25 = 50$; $x + 0.25 = 0.5$ 25; 0.25
   - $x + 15 = 20$; $x + 0.15 = 0.20$ 5; 0.05
   - $36 + x = 40$; $3.6 + x = 4.0$ 4; 0.4
   - $x - 10 = 33$; $x - 1.0 = 3.3$ 43; 4.3
   - $43 - x = 12$; $4.3 - x = 1.2$ 31; 3.1
   - $30 + 20 = 40 + x$; $0.3 + 0.2 = 0.4 + x$ 10; 0.1

BUILD (40 min) 

Into the Unknown

1. Direct students to apply their knowledge from Number Talk to solve Problem 1. Call on students to share their answers and strategies.
2. Ask students the following questions:



- *How did you estimate the value of the variable? Students may know that the answer is close to 2 because $8 + 2 = 10$. Remind students that they can always use whole numbers to help them check the reasonableness of their decimal answers.*
- *What are some different ways you can solve this problem? This problem can be solved with addition or subtraction.*
- *What strategy did you use to solve and why? Accept all reasonable answers.*
- *How can you check to see if your answer is correct? Students should know that the number represented by the variable can always be placed back into the equation to check the answer.*



3. Ask students to solve Problem 2. Call on students to share their answers and problem-solving strategies.
4. Ask students the following questions:



- *How is this problem similar to and different from Problem 1? Problem 2 is a subtraction problem, but they are still solving for a variable.*
- *Will the variable* T *be greater than or less than 2.45? How do you know? The variable will be greater than 2.45 because when 2.45 is subtracted 0.26 remains.*
- *How did you estimate the value of the variable? Accept all reasonable answers.*
- *Could you solve this problem efficiently with subtraction? Unlike Problem 1, Problem 2 may be more challenging to solve using subtraction.*
- *What ways can you solve this problem?* $2.45 + 0.26 = 2.71$
- *What strategy did you use to solve and why? Accept all reasonable answers.*

5. Tell students that they can use the inverse operation to find the value of *T*. Since 2.45 is subtracted from *T* on the left side of the equation, it needs to be added back to 0.26 on the right side of the equation.
   - How can you check to see if your answer is correct? Check it by replacing the variable with 2.71.
6. Ask students to complete Problems 3 through 10. Review the answers together. Take time to discuss Problem 8. Ask students the following questions:
   - How is this question different from the rest? There are addition problems on both sides of the equation.
   - What did you do to solve it? Accept all reasonable responses.

Into the Unknown
Teacher Note for #2:

If students struggle to see the relationship between the numbers, review fact families. Students can use this model with addition and subtraction problems to help them find the missing variable.

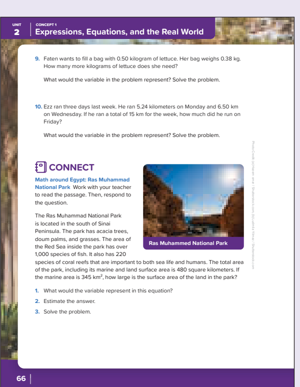
Into the Unknown
Teacher Note for #4:

This lesson focuses on having students explore the relationship between numbers and variables in equations. In Lesson 3, they will work with part-to-whole bar models to further understand why some equations can be solved with multiple operations and others with only one.

Answer Key for Into the Unknown

1. $p = 2.01$
2. $T = 2.71$
3. $n = 2.79$
4. $V = 57.12$
5. $h = 8.05$
6. $j = 15.41$
7. $m = 1.68$
8. $v = 3.90$
9. The variable represents the amount of lettuce to add to the bag. 0.12 kg
10. The variable represents how far he ran on Friday. 3.26 km

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UNIT 2 | CONCEPT 1 Expressions, Equations, and the Real World

9. Faten wants to fill a bag with 0.50 kilogram of lettuce. Her bag weighs 0.38 kg. How many more kilograms of lettuce does she need?

What would the variable in the problem represent? Solve the problem.

10. Ezz ran three days last week. He ran 5.24 kilometers on Monday and 6.50 km on Wednesday. If he ran a total of 15 km for the week, how much did he run on Friday?

What would the variable in the problem represent? Solve the problem.

CONNECT

Math around Egypt: Ras Muhammad National Park Work with your teacher to read the passage. Then, respond to the question.

The Ras Muhammad National Park is located in the south of Sinai Peninsula. The park has acacia trees, doum palms, and grasses. The area of the Red Sea inside the park has over 1,000 species of fish. It also has 220 species of coral reefs that are important to both sea life and humans. The total area of the park, including its marine and land surface area is 480 square kilometers. If the marine area is 345 km^2, how large is the surface area of the land in the park?

Ras Muhammed National Park

1. What would the variable represent in this equation?
2. Estimate the answer.
3. Solve the problem.

66



CONNECT (7 min)

Math around Egypt: Ras Muhammad National Park

Work with students to read the passage. Then, have students answer the questions. Ask students to explain their problem-solving strategies and discuss how they could check the reasonableness of their answers.

Answer Key for Math around Egypt: Ras Muhammad National Park

1. The surface area of the land in the park.
2. Estimate should be between 100 km^2 and 135 km^2.
3. 135 km^2

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to talk to a Shoulder Partner about how they would solve the problem. Ask students to share their thinking about why it might be important to be able to solve a problem in more than one way.
Accept all reasonable answers, including to check their work, or because one operation is easier for them than the other.

PRACTICE

1. $x = 3.92$
2. $v = 11.9$
3. $n = 0.35$
4. $c = 7.8$
5. $b = 3.72$



LESSON 3
Finding the Unknown

Lesson Overview

In this lesson, students extend their practice of solving decimal equations with variables to the Thousandths place. They also practice using inverse operations to solve equations. Students write variable equations to represent story problems using part-to-whole bar models as a visual tool.

Lesson Essential Questions

- How can operational relationships help you solve for a variable?
- How do numbers tell stories?

Lesson Learning Objectives

- Students will solve equations involving decimal numbers to the Thousandths place.
- Students will write equations to represent story problems with unknown quantities.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve story problems of one step on the addition and subtraction of decimal numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

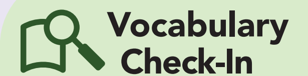
COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand why it is sometimes possible to write both addition and subtraction equations for a story problem.
- Students often find it challenging to understand the relationship between an equation and a story problem.

DIGITAL



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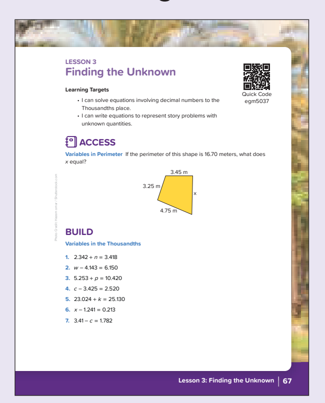
irregular polygon, perimeter

VIDEO LESSON



Quick Code: egmt5038

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LESSON 3

Finding the Unknown

Quick Code egm5037

Learning Targets

- I can solve equations involving decimal numbers to the Thousandths place.
- I can write equations to represent story problems with unknown quantities.

ACCESS

Variables in Perimeter If the perimeter of this shape is 16.70 meters, what does x equal?

Photo Credit: Hazem omar / Shutterstock.com

BUILD

Variables in the Thousandths

1. $2.342 + n = 3.418$
2. $w - 4.143 = 6.150$
3. $5.253 + p = 10.420$
4. $c - 3.425 = 2.520$
5. $23.024 + k = 25.130$
6. $x - 1.241 = 0.213$
7. $3.41 - c = 1.782$

Lesson 3: Finding the Unknown | 67



ACCESS (10 min)

Variables in Perimeter

1. Ask students what they remember about how to find the perimeter of a shape. Explain that the shape in the Student Materials is an irregular polygon.
2. Ask students to work with a partner to solve the problem. Then, ask students to share how they solved the problem. Students should add all of the known sides to make 11.45 m and then subtract 11.45 m from 16.70 m to get 5.25 m.
3. Ask students to discuss how they would write this as an equation with a variable. $3.45\text{ m} + 3.25\text{ m} + 4.75\text{ m} + x = 16.70\text{ m}$
4. Ask students the following questions:



- *Does the order of the known lengths in the equation matter? Why or why not? The order of the lengths and the variable x do not matter because of the Commutative Property of Addition.*
- *Could the equation be written as $16.70\text{ m} = 3.45\text{ m} + 3.25\text{ m} + 4.75\text{ m} + x$? Yes, because an equation is composed of two expressions with the same value joined by an equal sign. The order does not matter.*

Answer Key for Variables in Perimeter

$x = 5.25$ m

BUILD (40 min)



Variables in the Thousandths (20 min)

1. Call on students to share what they remember about how to solve for a variable (Lesson 2). Record their comments on the board. Then, direct students to solve Problem 1 with a Shoulder Partner.
2. Call on a student pair to share their strategy and their answer.
3. Confirm that students know that addition and subtraction are inverse operations. Then, ask students to solve Problem 2 with their Shoulder Partner.
4. Ask a pair of students to share their answers and problem-solving strategies. Then, ask if any other partners used the inverse operation to solve the problem.
5. Ask students to work independently to complete Problems 3 through 7. Go over the answers together.

Variables in the Thousandths

Teacher Note for #2:

In the last lesson, some students may have solved for *n* by counting on from 2.342 to 3.418. Students may want to continue this strategy, though it can be more difficult with numbers in the Thousandths. Using the inverse operation, in this case subtracting 2.342 from 3.418, might be the most efficient strategy for a multidigit problem.

Answer Key for Variables in the Thousandths

1. $n = 1.076$
2. $w = 10.293$
3. $p = 5.167$
4. $c = 5.945$
5. $k = 2.106$
6. $x = 1.454$
7. $c = 1.628$

Writing Equations to Match (20 min)

1. Ask students to read Problem 1 and work with their Shoulder Partner to write an equation to match the problem. (Students are not solving the equations at this time.)
2. Ask students the following questions about the story problem:



- *What information do we know? The total distance and the distance to El Tor*
- *What information is unknown? The distance from El Tor to Ras Muhammad National Park*
- *What equation can you write to match the problem?* *396.48 km + x = 492.64 km; 492.64 km − 396.48 km = x*

3. Tell students that they can draw a part-to-whole bar model to help them see the relationship between the numbers. Draw a bar model on the board (example shown). Review bar models as needed.

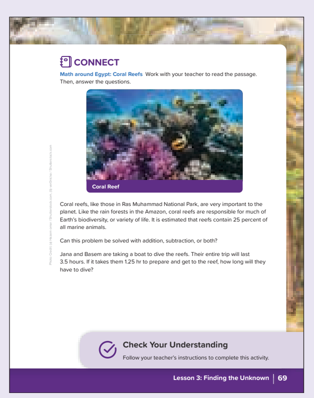
492.64 km	
396.48 km	x

4. Ask students to complete the rest of the problems on their own. If students finish early, ask them to solve the problems.
5. Review answers. Discuss any story problems that could be expressed with an addition or subtraction equation. Ask students why Problem 2 can only be expressed with addition.

Answer Key for Writing Equations to Match

1. 396.48 km + x = 492.64 km; 492.64 km − 396.48 km = x
2. 0.78 m + 0.58 m = x
3. 1.5 kg + 2.451 kg + x = 4.535 kg; 4.535 kg − 1.5 kg − 2.451 kg = x
4. $1.36 + x = 2.64$; $2.64 - x = 1.36$

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CONNECT (7 min)

Math around Egypt: Coral Reefs

Work with students to read the passage. Then, ask students to answer the question.

Answer Key for Math around Egypt: Coral Reefs

The problem can be solved using either addition or subtraction. The whole is known, but one of the parts is unknown, so both operations are possible.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask volunteers to share their answers and explanations for the CONNECT problem. Allow students to ask each other questions and to record examples on the board to illustrate their thinking.

PRACTICE

1. $p = 4.169$
2. $g = 9.923$
3. $j = 1.805$
4. $x = 3.98$
5. $80.25 - x = 35.50;\ 35.50 + x = 80.25$



LESSON 4
Telling Stories with Numbers

Lesson Overview

In this lesson, students continue to practice adding and subtracting decimals up to the Thousandths place in story problems. They also continue the work from Lesson 3, where they explored writing equations for story problems. They extend that skill to writing their own story problems for given equations.

Lesson Essential Questions

- How can operational relationships help you solve for a variable?
- How do numbers tell stories?

Lesson Learning Objectives

- Students will write story problems involving addition and subtraction of decimal numbers.
- Students will solve equations involving decimal numbers to the Thousandths place.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve story problems of one step on the addition and subtraction of decimal numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

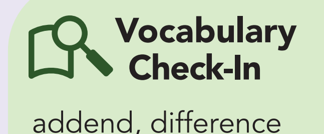
COMMON MISCONCEPTIONS AND ERRORS

- Students may not pay attention to place value when adding or subtracting decimal numbers with different amounts of digits.
- Students sometimes struggle to understand the relationship between an equation and a story problem.

DIGITAL



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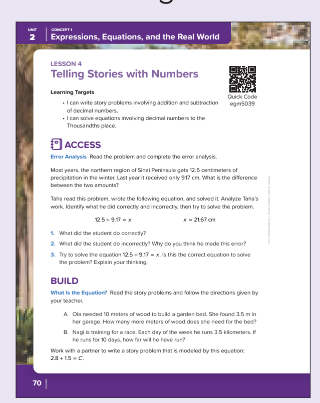
addend, difference

VIDEO LESSON



Quick Code: egmt5040

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UNIT 2 | CONCEPT 1 Expressions, Equations, and the Real World

LESSON 4
Telling Stories with Numbers

Quick Code egm5039

Learning Targets

- I can write story problems involving addition and subtraction of decimal numbers.
- I can solve equations involving decimal numbers to the Thousandths place.

ACCESS

Error Analysis Read the problem and complete the error analysis.

Most years, the northern region of Sinai Peninsula gets 12.5 centimeters of precipitation in the winter. Last year it received only 9.17 cm. What is the difference between the two amounts?

Taha read this problem, wrote the following equation, and solved it. Analyze Taha's work. Identify what he did correctly and incorrectly, then try to solve the problem.

$12.5 + 9.17 = x$ $x = 21.67$ cm

1. What did the student do correctly?
2. What did the student do incorrectly? Why do you think he made this error?
3. Try to solve the equation $12.5 + 9.17 = x$. Is this the correct equation to solve the problem? Explain your thinking.

BUILD

What Is the Equation? Read the story problems and follow the directions given by your teacher.

A. Ola needed 10 meters of wood to build a garden bed. She found 3.5 m in her garage. How many more meters of wood does she need for the bed?

B. Nagi is training for a race. Each day of the week he runs 3.5 kilometers. If he runs for 10 days, how far will he have run?

Work with a partner to write a story problem that is modeled by this equation: $2.8 + 1.5 = C$.

Photo Credit: Hazem omar / Shutterstock.com

70



ACCESS (10 min)

Error Analysis

Work with students to read the passage. Then, ask students to answer the questions. Ask students to share their answers and explain their thinking.

Answer Key for Error Analysis

1. Taha wrote an equation using the correct numbers and solved the written equation correctly.
2. Taha did not understand that difference meant to compare the two numbers using subtraction or a missing addend.
3. Correct equations could include $12.5 - 9.17 = x$ or $9.17 + x = 12.5$; $x = 3.33$ cm.

BUILD (40 min)



What Is the Equation? (15 min)

1. Ask students to read both story problems. Write $3.5 + x = 10$ on the board and ask students to think about which of the two story problems this equation represents and how they know.
2. Call on volunteers to share their thinking and how they determined which word problem matched the equation. The equation represents the first story problem.
3. Ask students:

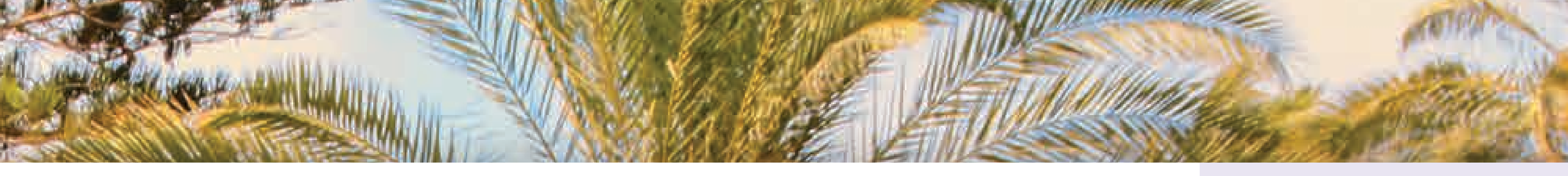


- *What does the 3.5 represent in this word problem? The amount of wood that Ola found in the garage*
- *What does the 10 represent in this word problem? The total amount of wood that Ola needs to build the frame*
- *What does the x in this equation represent? The missing amount of wood that Ola needs. It is a missing addend.*
- *What is the value of x? 6.5 m*
- *How did you solve? Some students will add up, others will use subtraction $10 - 3.5 = 6.5$, and others may use mental math.*

4. Ask students to work with a partner to write a new story problem. As students work, walk around and offer help where needed. After a few minutes, use Calling Sticks to select partners to read their story problems aloud.

Answer Key for What Is the Equation?

Accept all story problems that match the equation.



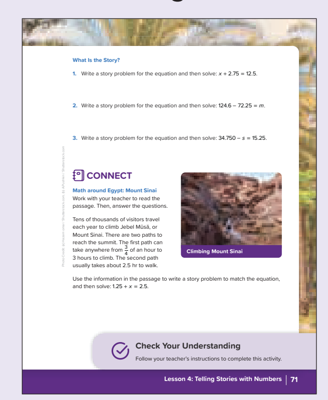
What Is the Story? (25 min)

1. Ask students to complete Problems 1 through 3. Remind students that they can utilize a bar model to solve the problems, if helpful.
2. If time allows, ask students to share their problems with a partner and discuss their strategies for writing and solving story problems with unknowns.

Answer Key for What Is the Story?

1. Story problems will vary. $x = 9.75$
2. Story problems will vary. $m = 52.35$
3. Story problems will vary. $s = 19.5$

Student Page 71



What Is the Story?

1. Write a story problem for the equation and then solve: $x + 2.75 = 12.5$.
2. Write a story problem for the equation and then solve: $124.6 - 72.25 = m$.
3. Write a story problem for the equation and then solve: $34.750 - s = 15.25$.

CONNECT

Math around Egypt: Mount Sinai

Work with your teacher to read the passage. Then, answer the questions.

Tens of thousands of visitors travel each year to climb Jebel Mūsā, or Mount Sinai. There are two paths to reach the summit. The first path can take anywhere from $\frac{3}{4}$ of an hour to 3 hours to climb. The second path usually takes about 2.5 hr to walk.

Climbing Mount Sinai

Use the information in the passage to write a story problem to match the equation, and then solve: $1.25 + x = 2.5$.

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 4: Telling Stories with Numbers | 71



CONNECT (7 min)



Math around Egypt: Mount Sinai

Ask students to read the passage and complete the problem.

Answer Key for Math around Egypt: Mount Sinai

Story problems will vary. $x = 1.25$

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their thinking about the Lesson Essential Question: *How do numbers tell stories?*

PRACTICE

1. B
2. 77.4 cm
3. B. $3.15 + 1.68 = x$
4. $x = 4.83$ km
5. 0.025 km

DIGITAL



Quick Code: egmt5041

CONCEPT CHECK-IN AND REMEDIATION
Expressions, Equations, and the Real World

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Unit 2, Concept 1 Expressions, Equations, and the Real World. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- How can operational relationships help you solve for a variable?
- How do numbers tell stories?

Learning Objective

- Students will correct misconceptions and errors related to expressions and equations.

Grade-Level Standards

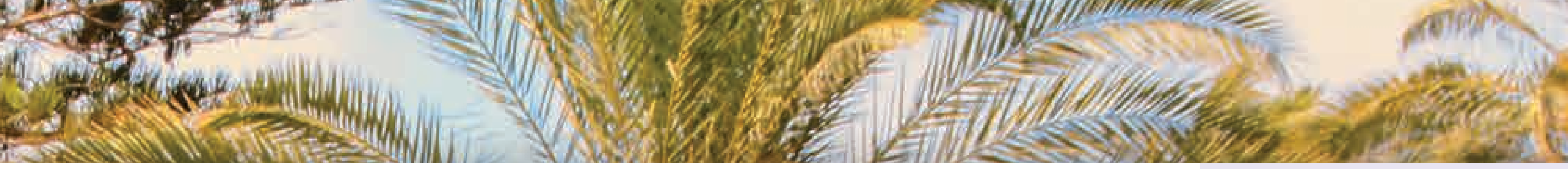
5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.a Add and subtract decimal numbers up to the Thousandths place.

5.C.1.b Solve story problems of one step on the addition and subtraction of decimal numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.



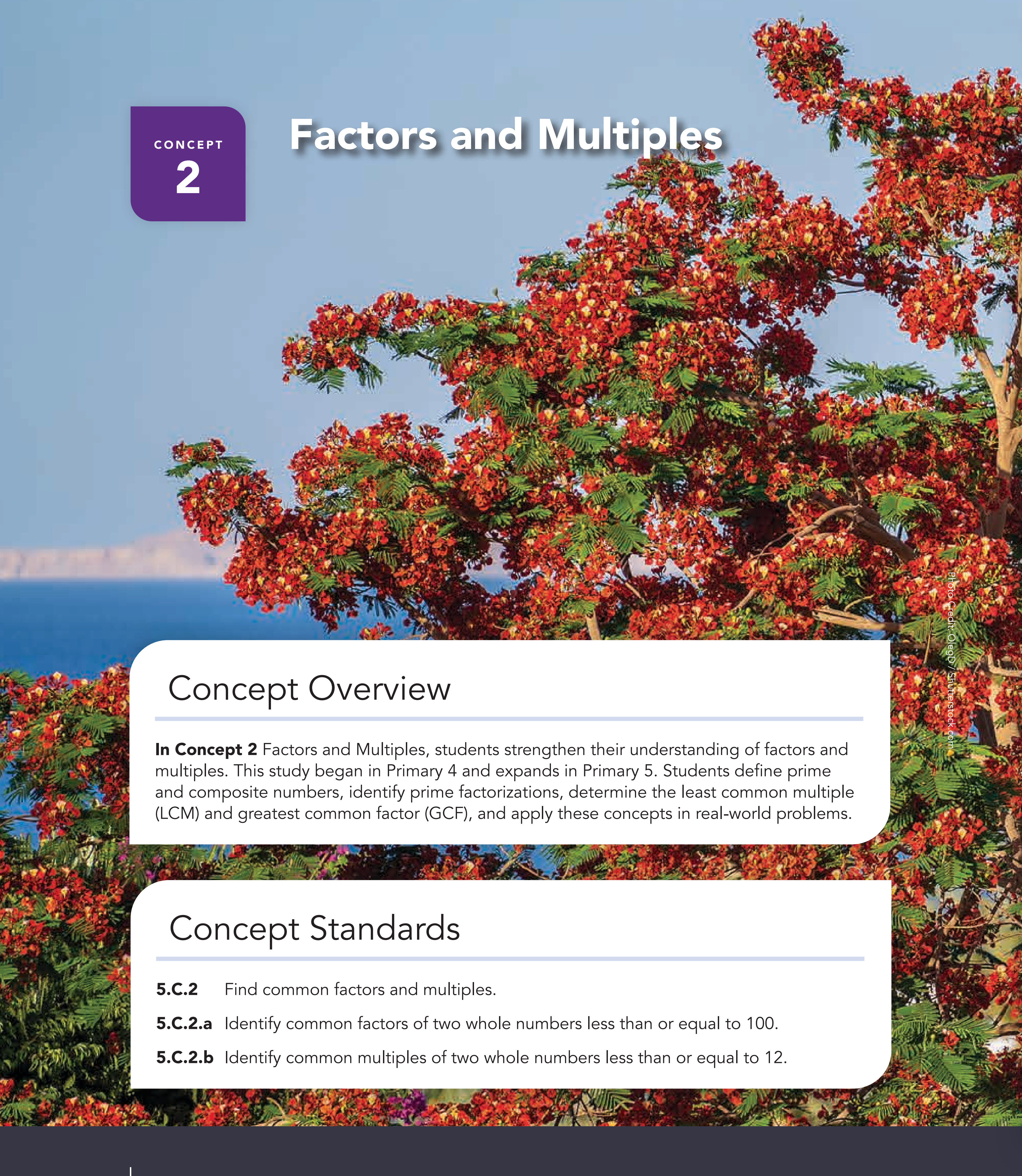
COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that the equal sign indicates balance. Both sides of the equal sign have the same value.
- Students may struggle to understand that the variable used, a letter or a symbol, does not matter, but that it represents the unknown quantity in an equation or expression.
- Students may not understand the inverse relationship between addition and subtraction and therefore struggle to solve problems with missing addends or subtrahends.
- Students may not pay attention to place value when adding or subtracting decimal numbers with different amounts of digits. For example, they may add or subtract Tenths with Hundredths or Ones with Tenths.
- Students may struggle to understand why you can sometimes express the same equation with either addition or subtraction.
- Students often struggle to understand the relationship between an equation and a story problem.

Remediation: Correcting Misconceptions

If . . .	**Then . . .**
Students do not understand that the equal sign indicates balance.	Review Lesson 1 and provide students with a variety of problems and practice such as $14 + 6 = 5 +$ ______ or $20 + 5 =$ ____$+ 15$. Help students recognize that the equal sign does not mean where the answer goes but rather signifies balance.
If . . .	**Then . . .**
Students struggle to understand that the letter or symbol used does not matter.	Review Lesson 1 and practice writing equations that use a variety of letters to represent the unknown quantity. Ensure students see that no matter the variable, the solution is still the same.
If . . .	**Then . . .**
Students struggle to understand why you use the inverse operation to solve for a variable.	Review Lesson 2's Number Talk and practice using smaller whole numbers so students can see the relationships.
If . . .	**Then . . .**
Students do not pay attention to place value when adding or subtracting decimal numbers with different amounts of digits.	Review Unit 1, Concept 2 Adding and Subtracting Decimals. Students may need lots of practice with decimal numbers and story problems.
If . . .	**Then . . .**
Students struggle to understand why you can sometimes write an equation for a story problem using both addition and subtraction.	Review Lesson 3 and practice using part-to-whole bar models to see which part of the equation is missing.
If . . .	**Then . . .**
Students struggle to understand the relationship between an equation and a story problem.	Review Lessons 3 and 4 reading story problems and crafting equations as well as writing story problems for a given equation.





CONCEPT 2

Factors and Multiples

Concept Overview

In Concept 2 Factors and Multiples, students strengthen their understanding of factors and multiples. This study began in Primary 4 and expands in Primary 5. Students define prime and composite numbers, identify prime factorizations, determine the least common multiple (LCM) and greatest common factor (GCF), and apply these concepts in real-world problems.

Concept Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.



LESSON 5
Finding Factors

Lesson Overview
In this lesson, students review and extend their understanding of factors from Primary 4. They define and discuss strategies for finding factors and prime and composite numbers. They find and list factors of numbers less than 100 and solve real-world problems that involve factors.

Lesson Essential Question
- What relationships are revealed by breaking numbers into their factors?

Lesson Learning Objectives
- Students will explain the meaning of factors.
- Students will identify the factors of a given number.

Grade-Level Standards
5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.

COMMON MISCONCEPTIONS AND ERRORS
Students may not understand that factors are numbers that, when multiplied, give you a product AND that factors are numbers that divide evenly into a larger number.



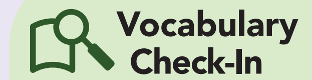

ACCESS (10 min)

Crossing Sinai
Work with students to read the passage, and then ask students to answer the questions. Go over the answers with the class. Ask volunteers to explain their problem-solving strategies.

Answer Key for Crossing Sinai
1. A. 10 km and C. 20 km
2. Accept all accurate answers. Examples include 2, 4, 5, 11, 22, 44, 55, and 110.

DIGITAL

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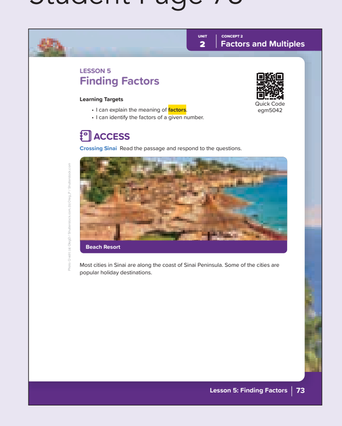


composite, divisor, factor, factor pair, prime, product

VIDEO LESSON

Quick Code: egmt5043

Student Page 73


UNIT 2 | CONCEPT 2 Factors and Multiples

LESSON 5
Finding Factors

Quick Code egm5042

Learning Targets
- I can explain the meaning of factors.
- I can identify the factors of a given number.

ACCESS
Crossing Sinai Read the passage and respond to the questions.

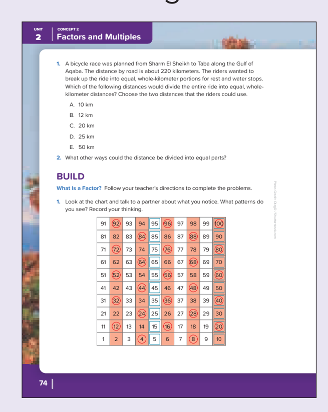
Beach Resort

Most cities in Sinai are along the coast of Sinai Peninsula. Some of the cities are popular holiday destinations.

Lesson 5: Finding Factors | 73



Student Page 74



BUILD (40 min) 

What Is a Factor?

1. Ask students to share what they remember about factors and products from Primary 4.
2. Reinforce the two definitions of factors and share examples as needed:
   - They are numbers that you multiply to get a product.
   - A factor of a number evenly divides into that number without any remainders.
3. Direct students' attention to the Think Like a Mathematician anchor chart and remind them that mathematicians look for patterns to help them solve problems. Ask students to talk to a partner about the Hundreds Chart in Problem 1 and then share with the class what they notice.
4. Direct students to solve Problem 2. Discuss the answers and ask the following questions:

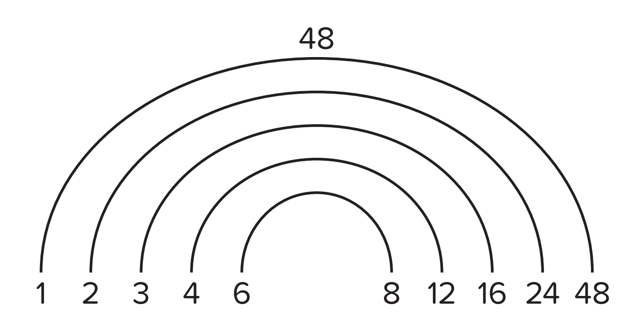


   - *How do you know if 2 is a factor of a given number? 5? 4? Answers should include all even numbers have 2 as a factor; 5 is a factor of all numbers that end in 5 and 0; 4 will be a factor if you can skip count by 4s to the given number or divide it evenly. Every number with 4 as a factor will also be even.*
   - *Why is 4 not a factor of 35? 35 cannot be divided evenly by 4.*
   - *What is the other factor that is multiplied by 2 to get 12? 40? 6; 20*
   - *What is the other factor that is multiplied by 5 to get 35? 7*
   - *Why does 17 not have 2, 4, or 5 as a factor? It is a prime number.*
   - *What are other factors of 12? 1, 3, 6, 12*
   - *What is a number that has 2, 4, and 5 as factors? Where are those numbers on the Hundreds chart? 20, 40, 60, 80, 100*
5. Write 48 on the board and ask students to share some strategies they use to find factors. Ask students to work with a partner to find the factors of 48. Answers may include factor rainbows, factor pairs, trial and error, skip counting, or arrays.
6. Review students' strategies. Record effective strategies.

What Is a Factor?
Teacher Note for #1:

This is a review from Primary 4, but some students may need additional practice finding factors. Students often need a lot of practice to find all the factors for a given number. Factors weave throughout division, story problems, and more complex algebraic equations in later grades, so taking time to ensure understanding is important.

7. Model using these strategies to identify the factors of 48. A factor rainbow is shown.



8. Ask students to work independently on Problems 3 to 7. At the end of BUILD, go over the answers together. Clear up any lingering misconceptions.

Answer Key for What Is a Factor?

1. Answers may vary.
2. A. 40: Yes, Yes, Yes; B. 12: Yes, No, Yes; C. 35: No, Yes, No; D. 17: No, No, No
3. 1, 3, 5, 15
4. $m = 4$; $v = 3$; $t = 7$; $p = 8$
5. D. 3 and 6
6. C
7. He is correct because 17 is a prime number.




CONNECT (7 min)

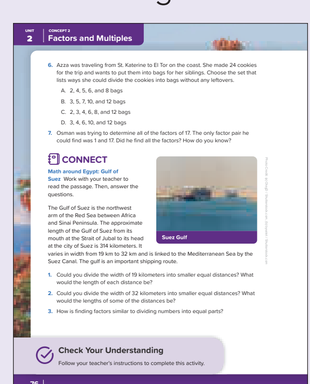
Math around Egypt: Gulf of Suez

Work with students to read the passage, and ask them to respond to the questions. Review the answers and clarify that 19 is a prime number and 32 is a composite number.

Answer Key for Math around Egypt: Gulf of Suez

1. Yes; 1 km
2. Yes; possible answers: 1, 2, 4, 8, 16
3. Answers may vary but should include the understanding that a number can be evenly divided by its factors.

Student Page 76





WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to use a Fist to Five to reflect on the Lesson's Learning Targets. Have volunteers share their reasons for their reflection.

PRACTICE

1. C. 2 and 11
2. B. 1 and 2
3. 1 and 27, 3 and 9
4. 7
5. 12 and 16



LESSON 6
Prime Factorization

Lesson Overview

In this lesson, students use factor trees to find prime factors of numbers less than 100. They write the prime factors in a multiplication sentence and discuss the term prime factorization. They also explore how the prime factorization of a number can help find all the factors of a whole number as well as the original product.

Lesson Essential Question

- What relationships are revealed by breaking numbers into their factors?

Lesson Learning Objective

- Students will use a factor tree to identify the prime factors of a given number.

Grade-Level Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.

COMMON MISCONCEPTIONS AND ERRORS

- Students may think that all prime numbers are odd or that all odd numbers are prime.
- When using a factor tree to find prime factors, students may believe that 1 is a prime number or students stop factoring before they identify all of the prime factors.




ACCESS (10 min)

Prime versus Composite (3 min)

Ask students to read and answer the question. Confirm the correct answer.

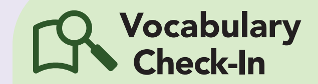
Answer Key for Prime versus Composite

A. A prime number has only 2 factors: 1 and itself. A composite number has more than two factors.

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Vocabulary Check-In

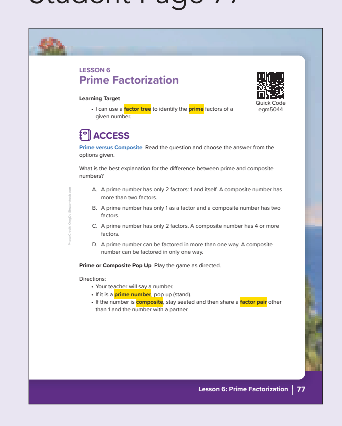
factor, factor trees, prime factorization

VIDEO LESSON



Quick Code: egmt5045

Student Page 77



LESSON 6
Prime Factorization

Learning Target

- I can use a **factor tree** to identify the **prime** factors of a given number.

Quick Code egm5044

ACCESS

Prime versus Composite Read the question and choose the answer from the options given.

What is the best explanation for the difference between prime and composite numbers?

A. A prime number has only 2 factors: 1 and itself. A composite number has more than two factors.
B. A prime number has only 1 as a factor and a composite number has two factors.
C. A prime number has only 2 factors. A composite number has 4 or more factors.
D. A prime number can be factored in more than one way. A composite number can be factored in only one way.

Prime or Composite Pop Up Play the game as directed.

Directions:
- Your teacher will say a number.
- If it is a **prime number**, pop up (stand).
- If the number is **composite**, stay seated and then share a **factor pair** other than 1 and the number with a partner.

Photo Credit: OlegD / Shutterstock.com

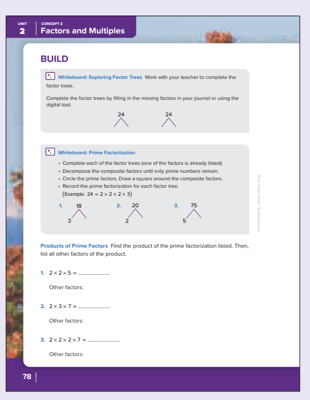
Lesson 6: Prime Factorization | 77



Prime or Composite Pop Up (7 min)

1. Play Prime or Composite Pop Up with the whole group. Directions:
   - State a number between 3 and 100.
   - Students pop up (stand) if the number is prime. They stay seated if the number is composite.
   - If the number is composite, students stay seated and turn to a partner and share a factor pair other than 1 and the number.
2. After a few rounds, ask students to talk to their Shoulder Partner about the questions *Are all prime numbers odd? Are all odd numbers prime?* Call on volunteers to explain their thinking. If necessary, ask for the factors of 15 to demonstrate that some odd numbers are actually composite.
3. Play Prime or Composite Pop Up again with the number 2. Remind students that they talked with their Shoulder Partner about the question, *Are all prime numbers odd?* For students who popped up, have them explain. Ask students to discuss why 2 is the only even prime number. 2 only has 1 and itself as factors. After 2, every other even number is composite because it has 2 as a factor along with 1 and itself.

Student Page 78


UNIT 2 | CONCEPT 2
Factors and Multiples

BUILD

Whiteboard: Exploring Factor Trees Work with your teacher to complete the factor trees.

Complete the factor trees by filling in the missing factors in your journal or using the digital tool.

24 24

Whiteboard: Prime Factorization

- Complete each of the factor trees (one of the factors is already listed).
- Decompose the composite factors until only prime numbers remain.
- Circle the prime factors. Draw a square around the composite factors.
- Record the prime factorization for each factor tree.
(Example: $24 = 2 \times 2 \times 2 \times 3$)

1. 18, 3 2. 20, 2 3. 75, 5

Photo Credit: OlegD / Shutterstock.com

Products of Prime Factors Find the product of the prime factorization listed. Then, list all other factors of the product.

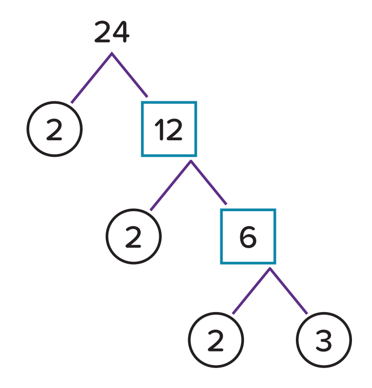
1. $2 \times 2 \times 5 =$ ______
Other factors:
2. $2 \times 3 \times 7 =$ ______
Other factors:
3. $2 \times 2 \times 2 \times 7 =$ ______
Other factors:

78

BUILD (40 min) 

Whiteboard: Exploring Factor Trees (10 min)

1. Ask students to share what they remember about factor trees. Explain to students that, although they may have many strategies for finding factors, today they will focus on factor trees and review how to use the tree-factoring method.
2. Model on the board how to make a factor tree for 24. Ask a student to share a factor pair that they know for 24. Use that pair as the first two factors in the tree. Then, model how to continue branching down until only prime number factors remain. When finished, circle the prime factors in the tree and put a square around the composite factors. Direct students to copy the tree into their Student Materials. An example is shown.



3. Explain that we can write the prime factors that were circled as a multiplication string. Mathematicians call this the prime factorization of a number. The prime factorization of 24 is $2 \times 2 \times 2 \times 3$.
4. Repeat with another factor pair of 24 (such as 4 and 6). Help students realize they will get the same prime factorization for 24 ($2 \times 2 \times 2 \times 3$) no matter what factor pair they choose at the start. Ask them to turn to a partner and share their thinking about why this occurs.
5. Explain that all numbers can be decomposed into a list of prime factors that cannot be decomposed into smaller factors. Usually, mathematicians write the list of prime factors in numerical order, such as $2 \times 2 \times 3$. It is helpful to find all the prime factors of a product because they are the building blocks of the number.

Answer Key for Whiteboard: Exploring Factor Trees

Answers will vary.

Whiteboard: Prime Factorization (10 min)

Ask students to use prime factorization to complete Problems 1 through 3. Go over the answers together.

Answer Key for Whiteboard: Prime Factorization

1. 18
   3 6
   2 3

   $3 \times 2 \times 3 = 18$ or $2 \times 3 \times 3 = 18$

2. 20
   2 10
   2 5

   $2 \times 2 \times 5 = 20$

3. 75
   5 15
   3 5

   $5 \times 3 \times 5 = 75$ or $3 \times 5 \times 5 = 75$



Products of Prime Factors (20 min)

1. Write $2 \times 3 \times 5$ on the board. Ask students the following questions:



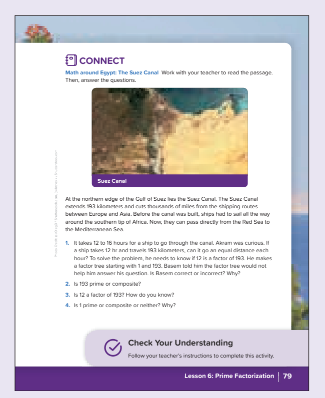
- *What product does this prime factorization create?* 30
- *What other factors are there for 30?* 1, 6, 10, 15, 30
- *What type of numbers are 6, 10, 15, and 30?* Composite

2. Model how the product of 6 could be found using 2 of the prime factors 2×3. Then, ask students if they could create 10 and 15 using any of the prime factors of 30. Yes, $2 \times 5 = 10$ and $3 \times 5 = 15$.
3. Explain to students that since the prime factors are the building blocks, all of the other composite factors can also be found using those prime factors.
4. Have students complete the remaining problems and review.

Answer Key for Products of Prime Factors

1. 20; 1, 4, 10, 20
2. 42; 1, 6, 14, 21, 42
3. 56; 1, 4, 8, 14, 28, 56

Student Page 79





CONNECT (7 min)



Math around Egypt: The Suez Canal

Ask students to respond to the questions. After a few minutes, review the answers clarifying that factor trees are only used for composite numbers since prime numbers only have two factors and one of them is 1. Be sure that students also understand that 1 would never show up in a factor tree since the branches end at prime numbers and 1 is not prime.

Answer Key for Math around Egypt: The Suez Canal

1. Basem is correct. If you start with 1 as a factor, then the other factor is the number you are trying to break down. It does not provide factors that you can decompose into prime factors.
2. Prime
3. No. Since 193 is prime, 12 is not a factor.
4. Neither. By definition, a prime number has two factors: 1 and itself. A composite number has more than two factors. However, the only factor of 1 is 1, so it cannot have a factor pair.



WRAP-UP (3 min)

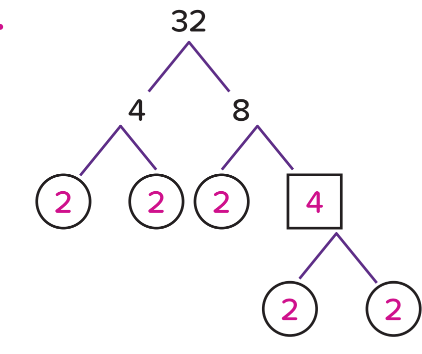


Let's Chat About Our Learning

Ask students to share their answers and thinking for the CONNECT questions. Encourage students to ask questions of each other. Clear up lingering misconceptions.

PRACTICE

1.



2. $2 \times 2 \times 2 \times 2 \times 2 = 32$

3. B. 9

4. B. Nour factored 14 incorrectly.

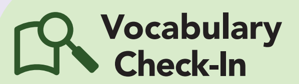
5. C. 81



DIGITAL



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egmt5046



Vocabulary Check-In

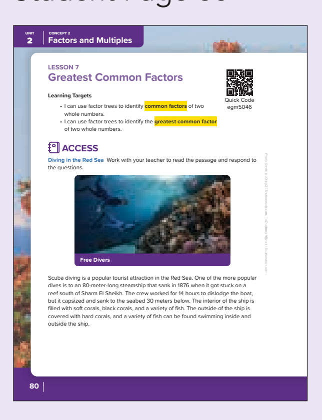
common factors, greatest common factor (GCF), Commutative Property of Multiplication

VIDEO LESSON



Quick Code:
egmt5047

Student Page 80



UNIT 2 | CONCEPT 2 Factors and Multiples

LESSON 7
Greatest Common Factors

Quick Code
egm5046

Learning Targets

- I can use factor trees to identify **common factors** of two whole numbers.
- I can use factor trees to identify the **greatest common factor** of two whole numbers.

ACCESS

Diving in the Red Sea Work with your teacher to read the passage and respond to the questions.

Free Divers

Scuba diving is a popular tourist attraction in the Red Sea. One of the more popular dives is to an 80-meter-long steamship that sank in 1876 when it got stuck on a reef south of Sharm El Sheikh. The crew worked for 14 hours to dislodge the boat, but it capsized and sank to the seabed 30 meters below. The interior of the ship is filled with soft corals, black corals, and a variety of fish. The outside of the ship is covered with hard corals, and a variety of fish can be found swimming inside and outside the ship.

80

LESSON 7
Greatest Common Factors

Lesson Overview

In this lesson, students continue to work with factor trees to record the prime factorization for whole numbers. They use factor trees and the prime factorization to identify common factors of two whole numbers as well as the greatest common factor of the two whole numbers.

Lesson Essential Question

- What relationships are revealed by breaking numbers into their factors?

Lesson Learning Objectives

- Students will use factor trees to identify common factors of two whole numbers.
- Students will use factor trees to identify the greatest common factor of two whole numbers.

Grade-Level Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.

COMMON MISCONCEPTIONS AND ERRORS

- Students may think that all prime numbers are odd or that all odd numbers are prime.
- When using a factor tree to find prime factors, students may believe that 1 is a prime number or students stop factoring before they identify all of the prime factors.

ACCESS (10 min)



Diving in the Red Sea

Work with students to read the passage and complete the problems. Allow students to take the lead, providing suggestions for problem-solving strategies and explaining their thinking. If time allows, solve the Challenge problem.



Answer Key for Diving in the Red Sea

1. C. 2 m, 3 m, 5 m, 6 m, 10 m, 15 m
2. A. 3 m, 5 m

Challenge C. 5 m

BUILD (40 min) 

What Do They Have in Common? (20 min)

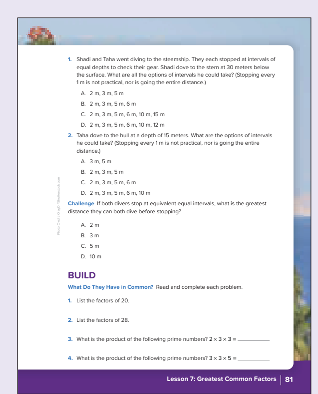
1. Ask students to solve Problems 1 and 2 using any strategy they choose. Ask students to share their answers. Record the factor trees for 20 and 28 on the board.
2. Ask a volunteer to record the prime factorization for 20. Allow students to help. Repeat with 28. Factor trees will vary based on what factor pair students begin with, but they will have the same prime factorization regardless.
3. Ask the following questions:



- *20 has 4 as a factor. What part of the prime factorization would equal 4?* 2×2
- *28 has 14 as a factor. What part of the prime factorization would equal 14?* 2×7
- *Looking at the list of factors, what is the greatest factor they share?* 4
- *What prime factor do both numbers share?* 2

4. Explain that mathematicians often want to find the greatest factor that two or more numbers share. This was introduced in Primary 4. Mathematicians call this the greatest common factor (GCF). To find the greatest common factor you can make a list of all the factors or use the prime factorization from a factor tree.
5. Model how to circle all the prime factors that both numbers share. Clarify that both numbers have 2×2 listed so what they share is 2×2 or 4, which was the greatest common factor found in the lists as well.
6. Ask students to complete Problems 3 and 4. Have them determine the product from the prime factorization.
7. Record $3 \times 3 \times 2 = n$ and $5 \times 3 \times 3 = n$ on the board and ask, "Will these prime factorizations still equal 18 and 45? Why?" Yes, the order doesn't matter because of the Commutative Property of Multiplication.

Student Page 81



1. Shadi and Taha went diving to the steamship. They each stopped at intervals of equal depths to check their gear. Shadi dove to the stern at 30 meters below the surface. What are all the options of intervals he could take? (Stopping every 1 m is not practical, nor is going the entire distance.)
   A. 2 m, 3 m, 5 m
   B. 2 m, 3 m, 5 m, 6 m
   C. 2 m, 3 m, 5 m, 6 m, 10 m, 15 m
   D. 2 m, 3 m, 5 m, 6 m, 10 m, 12 m
2. Taha dove to the hull at a depth of 15 meters. What are the options of intervals he could take? (Stopping every 1 m is not practical, nor is going the entire distance.)
   A. 3 m, 5 m
   B. 2 m, 3 m, 5 m
   C. 2 m, 3 m, 5 m, 6 m
   D. 2 m, 3 m, 5 m, 6 m, 10 m

Challenge If both divers stop at equivalent equal intervals, what is the greatest distance they can both dive before stopping?
   A. 2 m
   B. 3 m
   C. 5 m
   D. 10 m

BUILD

What Do They Have in Common? Read and complete each problem.

1. List the factors of 20.
2. List the factors of 28.
3. What is the product of the following prime numbers? $2 \times 3 \times 3 =$ ____
4. What is the product of the following prime numbers? $3 \times 3 \times 5 =$ ____

Photo Credit: OlegD / Shutterstock.com

Lesson 7: Greatest Common Factors | 81

What Do They Have in Common?
Teacher Note for #1:

In Primary 4, students found common factors and explored the concept of greatest common factor (GCF). This lesson provides more practice with factor trees and the opportunity to explore how to find the GCF as well as other factors from the prime factorization. This can be challenging. Some students will still prefer to make lists to find common and greatest common factors. However, this understanding is important as students move into more complex factor work in Primary 6.



8. Ask a volunteer to circle the prime factors that both prime factorizations share. 3×3 Then, ask students to find the product of these two common prime factors, which will be the GCF. 9 Clarify that 18 and 45 do have other factors in common such as 3 and 1, but the greatest factor they share is 9.

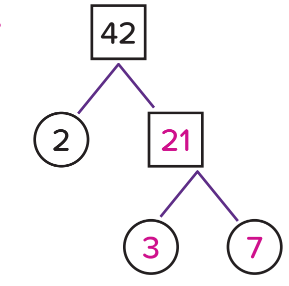
Answer Key for What Do They Have in Common?

1. 1, 2, 4, 5, 10, 20
2. 1, 2, 4, 7, 14, 28
3. 18
4. 45

Greatest Common Factors (20 min)

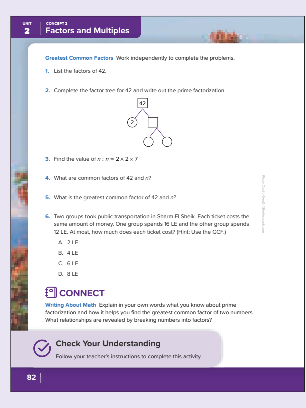
Direct students to work independently to complete the problems. At the end of BUILD, go over the answers together. Clear up any misconceptions.

Answer Key for Greatest Common Factors

1. 1, 2, 3, 6, 7, 14, 21, 42
2. 

   $2 \times 3 \times 7$
3. 28
4. 1, 2, 7, and 14
5. 14
6. B. 4 LE

Student Page 82



CONNECT (7 min)

Writing About Math

Ask students to explain in their own words what they know about prime factorization and how it helps them find the greatest common factor of two numbers. Ask them to explain what relationships are revealed by breaking numbers into factors.

Answer Key for Writing About Math

Answers will vary.



WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Allow students to ask each other questions to build understanding and clarify misconceptions.

PRACTICE

1. C. 1 LE, 2 LE, 3 LE, 6 LE, 9 LE
2. A. 1 LE, 3 LE, 7 LE
3. 3 LE
4. $2 \times 2 \times 3 \times 3$
5. $n = 48$
6. 6



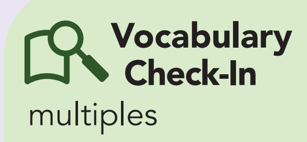
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Materials List

- Hundreds Charts (optional)



Vocabulary Check-In

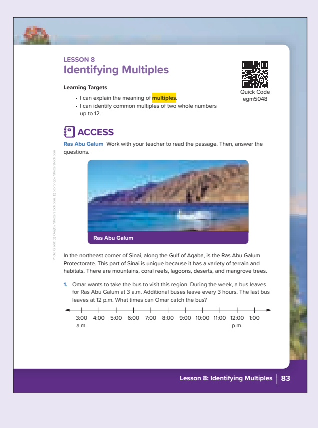
multiples

VIDEO LESSON



Quick Code:
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Student Page 83



LESSON 8
Identifying Multiples

Learning Targets

- I can explain the meaning of multiples.
- I can identify common multiples of two whole numbers up to 12.

Quick Code
egm5048

ACCESS

Ras Abu Galum Work with your teacher to read the passage. Then, answer the questions.

Ras Abu Galum

In the northeast corner of Sinai, along the Gulf of Aqaba, is the Ras Abu Galum Protectorate. This part of Sinai is unique because it has a variety of terrain and habitats. There are mountains, coral reefs, lagoons, deserts, and mangrove trees.

1. Omar wants to take the bus to visit this region. During the week, a bus leaves for Ras Abu Galum at 3 a.m. Additional buses leave every 3 hours. The last bus leaves at 12 p.m. What times can Omar catch the bus?

3:00 a.m. 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 p.m. 1:00

Lesson 8: Identifying Multiples | 83

LESSON 8
Identifying Multiples

Lesson Overview

In this lesson, students consider multiples in real life using a number line to determine a bus schedule. Students review skip counting to help name multiples. Then, they find multiples for given number pairs and look for common multiples. Finally, they discuss how multiples, unlike factors, are infinite.

Lesson Essential Question

- How are all numbers related through factors and multiples?

Lesson Learning Objectives

- Students will explain the meaning of multiples.
- Students will identify common multiples of two whole numbers up to 12.

Grade-Level Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.

COMMON MISCONCEPTIONS AND ERRORS

Students often confuse factors and multiples.



ACCESS (10 min)



Ras Abu Galum

Work with students to read the passage and answer the questions. Ask volunteers to explain their thinking and model their solutions.

Answer Key for Ras Abu Galum

1. 3 a.m., 6 a.m., 9 a.m., 12 p.m.
2. 6 a.m., 8 a.m., 10 a.m., 12 p.m.
3. 6 a.m., 12 p.m.



BUILD (40 min) 

Skipping Along (20 min)

1. As a class, practice skip counting either as a whole group, or with each student saying the next number in sequence. Begin counting by 2. Repeat for 3, 5, 7, and 11.
2. Tell students that when they skip count, they say the multiples of a number: 2, 4, 6, and 8 are all multiples of 2. Write on the board: $2 \times 1 = 2$; $2 \times 2 = 4$; $2 \times 3 = 6$.
3. Ask students to discuss the following questions with a partner:



- *Which numbers are the factors in these equations? The factors are the numbers being multiplied: 2 and 1; 2 and 2; 2 and 3.*
- *Which numbers are the multiples? The products: 2, 4, and 6*

4. Direct students to solve Problem 1, and then discuss with a partner the strategy they used to find multiples of 6. Ask students to share their strategies with the class.
5. Ask students to complete Problems 2 through 6. Review and check answers as a class.

Answer Key for Skipping Along

1. 6, 12, 18, 24, 30
2. 7, 14, 21, 28, 35, 42
3. Answers will vary, but may include: 10, 20, 30, 40, 50, 60, or larger multiples like 100, 150, or 2,000
4. 24, 36, 48, 60, 72
5. 18, 27, 36, 45, 54
6. 3 cartons of eggs and 4 packs of juice

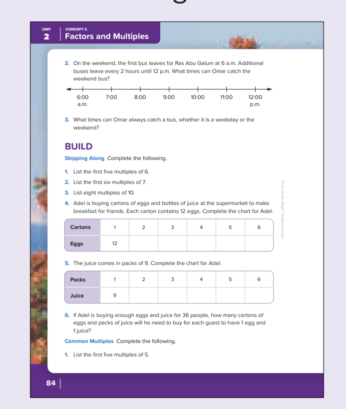
Common Multiples (20 min)

1. Explain that common multiples are multiples that are the same for given numbers. They are multiples that the numbers have in common.
2. Ask students to look at Problems 4 and 5 from Skipping Along and identify the common multiple of 9 and 12. 36
3. Ask students to work independently on Problems 1 through 15. Go over the answers together. Then, ask the following questions:



- *How high do you have to go to find a common multiple? This depends, but they should see that they can always find a common multiple by multiplying the two numbers together. However, there may be a smaller multiple that the two numbers have in common.*

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Skipping Along
Teacher Note for 4:

If students are struggling with their multiplication facts, briefly review how to use a Hundreds chart to find multiples.



Common Multiples
Teacher Note for #4:

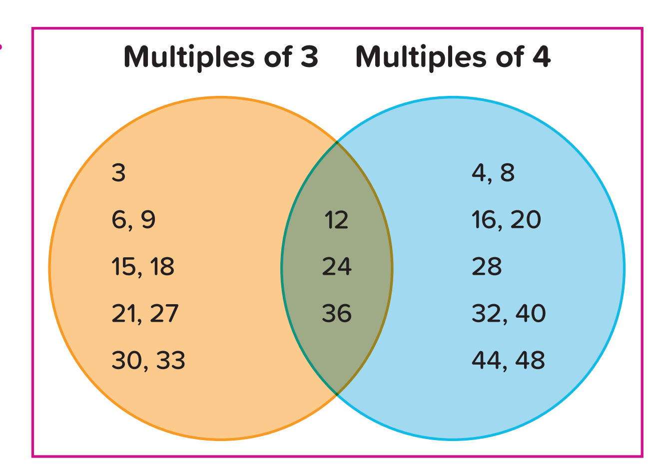
This will be discussed more fully in the next lesson. At this point, students should understand that they can find common multiples for more than 2 numbers.

- *Will two numbers always have a common multiple? Yes*
- *Could you find a common multiple of 3 numbers? What about 4? Yes, we can find common multiples of an infinite quantity of numbers.*

4. Ask students to look at Problems 1 and 2 where they found common multiples for 5 and 2. Ask students to work with their Shoulder Partner to see if they can find a common multiple for 5, 2, and 3. 30. Students may see that this is the product of the three numbers.

Answer Key for Common Multiples

1. 5, 10, 15, 20, 25
2. 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
3. 10, 20
4. 8, 16, 24, 32, 40
5. 4, 8, 12, 16, 20, 24
6. 6, 12, 18, 24, 30
7. 24
8. 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36
9. 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48
10. 12, 24, 36
11.



12. A, B, D
13. A, C, F
14. 60 cm
15. 15 track pieces



CONNECT (7 min)

Writing About Math

Ask students to respond in their math notebook to the question.

Answer Key for Writing About Math

Factors are finite and multiples are infinite. There are a limited number of factors that divide evenly into numbers, but there is a limitless quantity of multiples because numbers are infinite.

WRAP-UP (3 min)



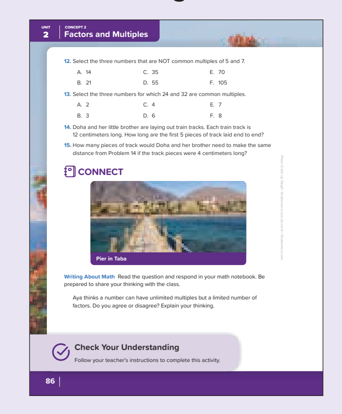
Let's Chat About Our Learning

Ask students to share their answers and explanations for the CONNECT question. Reinforce correct answers.

PRACTICE

1. Answers will vary but may include 6, 12, and 18.
2. Answers will vary but may include 24 or 48.
3. E and F
4. 5 and 10; The numbers are multiples of 5 and 10 because all numbers that end in 0 are multiples of 10. Multiples of 5 end in 5 or 0.
5. Answers will vary but may include 72.

Student Page 86


UNIT 2 | CONCEPT 2 Factors and Multiples

12. Select the three numbers that are NOT common multiples of 5 and 7.

A. 14 C. 35 E. 70
B. 21 D. 55 F. 105

13. Select the three numbers for which 24 and 32 are common multiples.

A. 2 C. 4 E. 7
B. 3 D. 6 F. 8

14. Doha and her little brother are laying out train tracks. Each train track is 12 centimeters long. How long are the first 5 pieces of track laid end to end?

15. How many pieces of track would Doha and her brother need to make the same distance from Problem 14 if the track pieces were 4 centimeters long?

CONNECT

Pier in Taba

Writing About Math Read the question and respond in your math notebook. Be prepared to share your thinking with the class.

Aya thinks a number can have unlimited multiples but a limited number of factors. Do you agree or disagree? Explain your thinking.

Check Your Understanding
Follow your teacher's instructions to complete this activity.

86



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Vocabulary Check-In

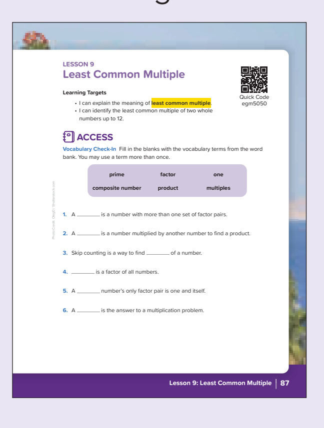
composite number, factor, least common multiple, multiple, prime number, product

VIDEO LESSON



Quick Code:
egmt5051

Student Page 87



LESSON 9
Least Common Multiple

Quick Code
egm5050

Learning Targets

- I can explain the meaning of **least common multiple**.
- I can identify the least common multiple of two whole numbers up to 12.

ACCESS

Vocabulary Check-In Fill in the blanks with the vocabulary terms from the word bank. You may use a term more than once.

prime	factor	one
composite number	product	multiples

1. A ________ is a number with more than one set of factor pairs.
2. A ________ is a number multiplied by another number to find a product.
3. Skip counting is a way to find ________ of a number.
4. ________ is a factor of all numbers.
5. A ________ number's only factor pair is one and itself.
6. A ________ is the answer to a multiplication problem.

Photo Credit: OlegD / Shutterstock.com

Lesson 9: Least Common Multiple | 87

LESSON 9
Least Common Multiple

Lesson Overview

In this lesson, students expand their knowledge of common multiples to learn how to identify the least common multiple (LCM). They think about what is unique about finding an LCM for a pair of prime numbers and create and test a hypothesis about their nature. Finally, they apply their understanding of the LCM to solve real-world story problems.

Lesson Essential Question

- How are all numbers related through factors and multiples?

Lesson Learning Objectives

- Students will explain the meaning of least common multiple.
- Students will identify the least common multiple of two whole numbers up to 12.

Grade-Level Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.

COMMON MISCONCEPTIONS AND ERRORS

Students may struggle to find a reliable strategy to find multiples of a given number.



ACCESS (10 min)



Vocabulary Check-In and Using Vocabulary

Direct students to complete the learning activities. Review all answers together. If time allows, ask students to select two terms from the word bank and connect them in a sentence.



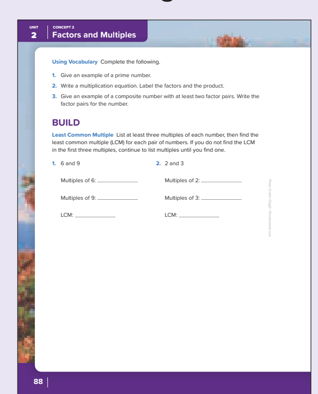
Answer Key for Vocabulary Check-In

1. composite number
2. factor
3. multiples
4. one
5. prime
6. product

Answer Key for Using Vocabulary

1. Answers will vary but should be a number whose factors are only 1 and itself.
2. Answers will vary. Example: $4(\text{factor}) \times 5(\text{factor}) = 20(\text{product})$
3. Answers will vary. Example: 40; factor pairs: $(1,40)$; $(2,20)$; $(4,10)$; $(5,8)$

Student Page 88



BUILD (40 min) 

Least Common Multiple (30 min)

1. Ask students to talk to their Shoulder Partner to identify two multiples that 4 and 6 share and how they know they are correct. Multiples of 4 and 6 will vary. Since 4 and 6 are both multiples of 2, they share many common multiples.
2. Tell students that the least common multiple is the smallest multiple that two or more numbers have in common, and is also called the LCM. Ask students to talk to their Shoulder Partner about what the LCM of 4 and 6 would be. 12
3. Ask students to complete Problems 1 through 6 and the Challenge problem. When students are finished, direct students to Problem 4 and ask them the following questions:



- *How high did you have to multiply to find the LCM?*
- *Did anyone have a strategy that was different from listing out the multiples? Accept all strategies that yield correct answers.*

4. Ask students to look at Problem 5. Ask students to talk to their Shoulder Partner about what they notice about the numbers and their LCM. Call on students to share their thinking. Both numbers are prime, and their LCM is found by multiplying 5×11.
5. Ask students if they think this applies to all prime number pairs. Give them three to five minutes to experiment with other prime numbers to either prove or disprove their hypothesis.



Least Common Multiple
Teacher Note for #7:

Noticing the relationship between LCM and prime numbers will help students in Primary 6 and beyond when they will use prime factorization to find the LCM of larger numbers. Prime factorization is the simplest way to find the LCM of three numbers, but students are not expected to use this method at this time.

6. Ask student pairs to share their thinking with the class. If both numbers are prime, the LCM Is the product of those two numbers.
7. If your class is ready for a challenge, discuss the Challenge question. Ask students to share any strategy they used to determine the LCM of three numbers. Students may have started by finding multiples of the largest number first (12) up to 100 and then found the multiples of the smaller numbers. Or they may have multiplied the three numbers together, which would give a multiple, but not the LCM.

Answer Key for Least Common Multiple

1. Multiples: 6, 12, 18; Multiples: 9, 18, 27; LCM: 18
2. Multiples: 2, 4, 6; Multiples: 3, 6, 9; LCM: 6
3. Multiples: 10, 20, 30; Multiples: 5, 10, 15; LCM: 10
4. Multiples: 3, 6, 9, 12, 15, 18, 21, 24; Multiples: 8, 16, 24, 32, 40, 48; LCM: 24
5. Multiples: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55; Multiples: 11, 22, 33, 44, 55; LCM: 55
6. Multiples: 5, 10, 15, 20, 25, 30; Multiples: 6, 12, 18, 24, 30; LCM: 30

Challenge 84

LCMs in the Real World (10 min)

Tell students that these two problems show real world applications of the LCM. Have students solve the problems, and then check the answers together.

Answer Key for LCMs in the Real World

1. 12 of each; 4 packages of kofta and 1 package of aish baldi

Package	1	2	3	4	5	6
Kofta	3	6	9	12	15	18

Package	1	2	3	4	5	6
Aish Baldi	12	24	36	48	60	72



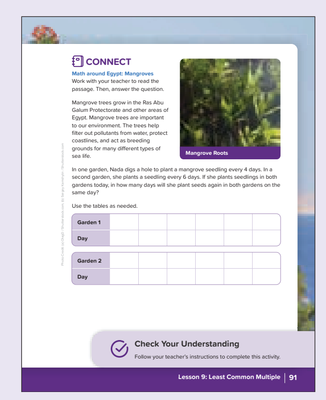
2. 24 minutes

Lap	1	2	3	4	5	6
Hend	6	12	18	24	30	36

Lap	1	2	3	4	5	6
Jana	8	16	24	32	40	48

CONNECT (7 min) 

Student Page 91



Math around Egypt: Mangroves

Work with students to read the passage. Then, ask students to answer the question. Go over the answer together and ask students to share the problem-solving strategies they used.

Answer Key for Math around Egypt: Mangroves

12 days

WRAP-UP (3 min)

 **Let's Chat About Our Learning**

Ask students to work with a partner to define *least common multiple*. Call on students to share their definitions with the class.
The least common multiple is the smallest multiple that two or more numbers share.

PRACTICE

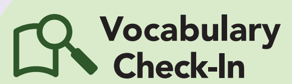
1. 12
2. 24
3. 18
4. 24
5. 60th customer



DIGITAL



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Vocabulary Check-In

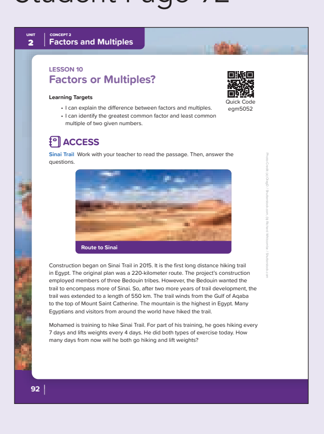
finite, greatest common factor (GCF), infinite, least common multiple (LCM)

VIDEO LESSON



Quick Code:
egmt5053

Student Page 92



UNIT 2 | CONCEPT 2 Factors and Multiples

LESSON 10
Factors or Multiples?

Quick Code
egm5052

Learning Targets

- I can explain the difference between factors and multiples.
- I can identify the greatest common factor and least common multiple of two given numbers.

ACCESS

Sinai Trail Work with your teacher to read the passage. Then, answer the questions.

Route to Sinai

Construction began on Sinai Trail in 2015. It is the first long distance hiking trail in Egypt. The original plan was a 220-kilometer route. The project's construction employed members of three Bedouin tribes. However, the Bedouin wanted the trail to encompass more of Sinai. So, after two more years of trail development, the trail was extended to a length of 550 km. The trail winds from the Gulf of Aqaba to the top of Mount Saint Catherine. The mountain is the highest in Egypt. Many Egyptians and visitors from around the world have hiked the trail.

Mohamed is training to hike Sinai Trail. For part of his training, he goes hiking every 7 days and lifts weights every 4 days. He did both types of exercise today. How many days from now will he both go hiking and lift weights?

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LESSON 10
Factors or Multiples?

Lesson Overview

In this lesson, students find the greatest common factor (GCF) and the least common multiple (LCM) of different number pairs. They identify the difference between these concepts and distinguish which one is needed to solve story problems. At the end of this lesson, students answer the Essential Question: *How are all numbers related through factors and multiples?*

Lesson Essential Question

- How are all numbers related through factors and multiples?

Lesson Learning Objectives

- Students will explain the difference between factors and multiples.
- Students will identify the greatest common factor and least common multiple of two given numbers.

Grade-Level Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.

COMMON MISCONCEPTIONS AND ERRORS

Students are often confused about the difference between greatest common factor (GCF) and least common multiple (LCM).



ACCESS (10 min)



Sinai Trail

Work with students to read the passage, and then ask them to respond to the question. Ask volunteers to share their answers and explain their thinking. If students are unsure how to solve this problem, create tables for each type of exercise.

Answer Key for Sinai Trail

28 days



BUILD (40 min)




Factors and Multiples (10 min)

1. Ask students to share what they remember about the greatest common factor (GCF) of two numbers.
2. Ask students to share what they remember about the least common multiple (LCM).
3. Ask students to discuss the questions with their Shoulder Partner, and then solve.
4. Ask students to share their answers and observations.

Answer Key for Factors and Multiples

Factors should include two of the following: 1, 2, 4. Multiples will vary but may include 24, 48, and 72. Observations may include: factors are finite and multiples are infinite; all of the multiples are even numbers. The LCM is 24 and the GCF is 4.

Greatest and Least (10 min)

If students need additional review of finding the GCF and LCM, work with them to do several problems or have some students work with a partner. Go over the answers together.

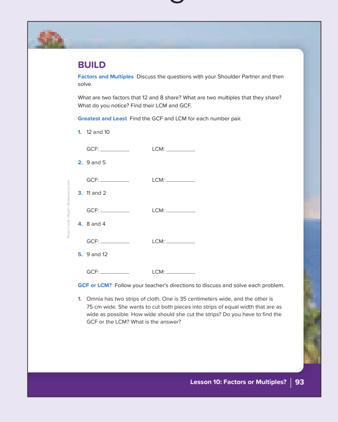
Answer Key for Greatest and Least

1. GCF: 2; LCM: 60
2. GCF: 1; LCM: 45
3. GCF: 1; LCM: 22
4. GCF: 4; LCM: 8
5. GCF: 3; LCM: 36

GCF or LCM? (20 min)

1. Tell students that now they will read story problems and decide whether they have to find the GCF or LCM to solve the problem. Ask students what kinds of story problems or operations might involve finding the GCF. These problems usually involve dividing, cutting into pieces, or breaking something into groups.
2. Ask students what kinds of story problems or operations might involve finding the LCM. These problems usually involve something repeated, multiple items, or when two things will occur at the same time.

Student Page 93


BUILD

Factors and Multiples Discuss the questions with your Shoulder Partner and then solve.

What are two factors that 12 and 8 share? What are two multiples that they share? What do you notice? Find their LCM and GCF.

Greatest and Least Find the GCF and LCM for each number pair.

1. 12 and 10

   GCF: ________ LCM: ________

2. 9 and 5

   GCF: ________ LCM: ________

3. 11 and 2

   GCF: ________ LCM: ________

4. 8 and 4

   GCF: ________ LCM: ________

5. 9 and 12

   GCF: ________ LCM: ________

GCF or LCM? Follow your teacher's directions to discuss and solve each problem.

1. Omnia has two strips of cloth. One is 35 centimeters wide, and the other is 75 cm wide. She wants to cut both pieces into strips of equal width that are as wide as possible. How wide should she cut the strips? Do you have to find the GCF or the LCM? What is the answer?

Lesson 10: Factors or Multiples? | 93



3. Ask students to read Problem 1 with their partner and discuss whether the GCF or LCM is needed. Since the problem involves cutting or breaking something into smaller pieces, it is a GCF problem. Call on partner pairs to share their thoughts. Then, ask students to work with their partner to solve the problem. Go over the answer together.

4. Repeat with Problem 2. Since the problem is looking for the smallest multiple that is common for each number, students must find the LCM.

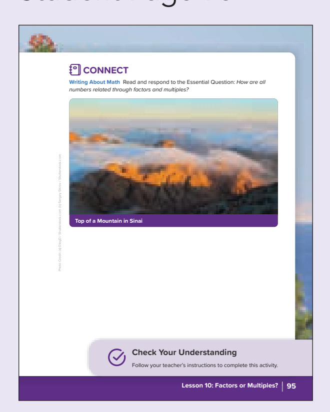
5. Ask volunteers to explain the difference between GCF and LCM in their own words. Then, have students complete Problems 3 through 6 (independently, in pairs, or with the whole group). Clear up any lingering misconceptions.

Answer Key for GCF or LCM?

1. GCF; 5 cm
2. LCM; 24 days
3. LCM; 40 pencils
4. GCF; 6 snack bags
5. GCF; 6 containers
6. LCM; 63 figs and 63 pomegranates



Student Page 95





CONNECT (7 min)



Writing About Math

Ask students to answer the Essential Question: *How are all numbers related through factors and multiples?*

Answer Key for Writing About Math

Accept all reasonable answers. Answers may include:

- All numbers have a limitless number of multiples, but not all numbers have the same quantity of factors.
- A multiple is the product of two factors.
- Factors are multiplied together to make multiples.
- When a number is divided evenly it is broken into factors.
- Two factors make up a multiple.



WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to work with a partner to explain the difference between the LCM and the GCF to a younger friend. How are they similar? How are they different? Ask volunteers to share their thinking.
Students should see that both GCF and LCM are finding something that a set of numbers has in common. The GCF is the largest factor that divides evenly into a set of numbers. The LCM is the smallest multiple that is shared by a set of numbers.

PRACTICE

1. GCF: 1; LCM 90
2. GCF: 1; LCM 21
3. GCF: 2; LCM 24
4. 8 groups
5. 17 packs



DIGITAL



Quick Code:
egmt5054

CONCEPT CHECK-IN AND REMEDIATION
Factors and Multiples

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Unit 2, Concept 2 Factors and Multiples. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What relationships are revealed by breaking numbers into their factors?
- How are all numbers related through factors and multiples?

Lesson Learning Objective

- Students will correct misconceptions and errors related to factors and multiples.

Grade-Level Standards

5.C.2 Find common factors and multiples.

5.C.2.a Identify common factors of two whole numbers less than or equal to 100.

5.C.2.b Identify common multiples of two whole numbers less than or equal to 12.



COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that factors are numbers that, when multiplied, give you a product and that factors are numbers that divide evenly into a larger number.
- Students may think that all prime numbers are odd or that all odd numbers are prime.
- When using a factor tree to find prime factors, students may believe that 1 is a prime number or students stop factoring before they identify all of the prime factors.
- Students often confuse factors and multiples.
- Students may struggle to find a reliable strategy to find multiples of a given number.
- Students are often confused about the difference between greatest common factor (GCF) and least common multiple (LCM).



Remediation: Correcting Misconceptions

If . . .	Then . . .
Students do not understand that factors are both numbers that, when multiplied, give you a product and that factors are numbers that divide evenly into a larger number.	Review Lesson 5. Use numbers that are less than 50 to start, and model a variety of strategies to find factors. Have students use manipulatives to build a variety of arrays for a given number and list the factors.
If . . .	**Then . . .**
Students think that all odd numbers are prime.	Review Lesson 6 ACCESS. Have students build arrays for a variety of odd numbers such as 15, 35, and 39 so they can see that not all odd numbers are prime.
If . . .	**Then . . .**
Students believe that 1 is a prime number or students stop factoring before they identify all of the prime factors.	Review Lessons 6 and 7. Help students create a list of prime numbers to use to check their factorization. Provide a lot of practice making factor trees for numbers, such as 15, 18, and 28, that have fewer factors. Help students by starting their factor tree with at least one prime number so that only one branch continues—this makes it visually easier to manage. Remind students to circle the prime numbers as they go. This will help them to list all the primes and also write the prime factorization.
If . . .	**Then . . .**
Students confuse factors and multiples.	Review Lesson 5 on factors and Lesson 8 on multiples. Ask students to write both multiplication and division equations labeling the factors and multiples in the equations. Remind students that there are a finite number of factors for a number, but an infinite number of multiples.



If . . .	Then . . .
Students struggle with a reliable strategy to help them find multiples of a given number.	Review Lessons 8 and 9. Allow students to use Hundreds charts when necessary and practice skip counting on the charts. Also practice skip counting with the class. This can be done as a quick daily review during ACCESS.
If . . .	**Then . . .**
Students are confused about the difference between greatest common factor (GCF) and least common multiple (LCM).	Review Lesson 10 BUILD. Students can solve similar problems with number pairs finding the LCM and GCF. Discuss the types of story problems and real-life situations that would ask for each.

UNIT

3

MULTIPLICATION WITH WHOLE NUMBERS

Theme 1 | Number Sense and Operations

ESSENTIAL QUESTIONS

- How can we use our understanding of place value to multiply large numbers efficiently?
- How do mathematicians use models to make sense of problems?
- How can models help mathematicians understand how and why algorithms work?

Video Questions


Quick Code egmt5055

The Unit 3 Opener Video, Multiplying Books, explores math around Egypt through multiplication. In this unit, students use models to help build their understanding of multiplication. They learn how to use place value to solve multiplication problems.

- How did multiplication help the students make sense of the world around them?
- What did the students find out about multiplication and place value?

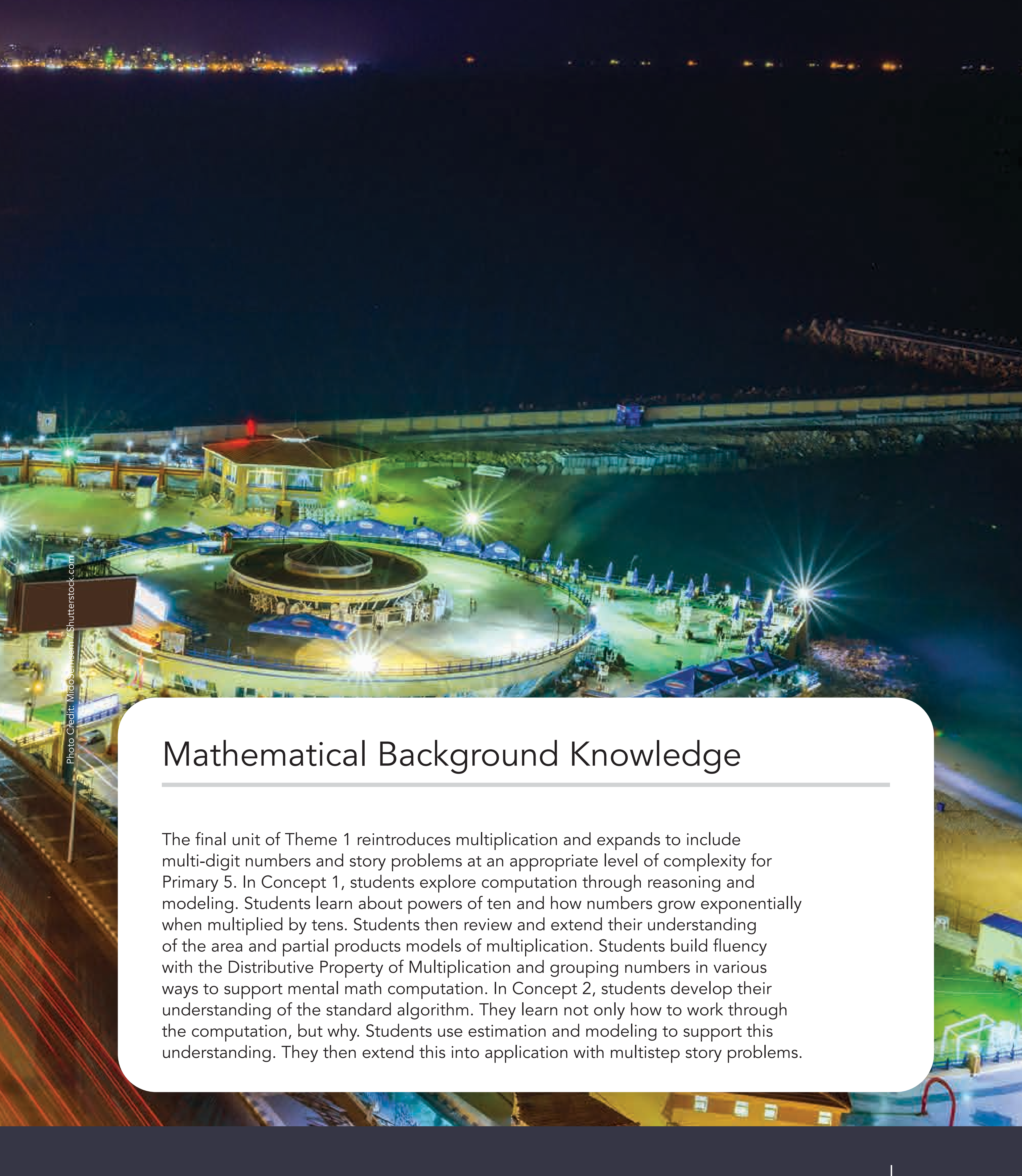


Key Vocabulary


Quick Code egmt5056

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

algorithm, area model, Commutative Property of Multiplication, Distributive Property of Multiplication, factor tree, partial products, powers of ten, Three Reads Strategy


Photo Credit: MidoSemsem / Shutterstock.com

Mathematical Background Knowledge

The final unit of Theme 1 reintroduces multiplication and expands to include multi-digit numbers and story problems at an appropriate level of complexity for Primary 5. In Concept 1, students explore computation through reasoning and modeling. Students learn about powers of ten and how numbers grow exponentially when multiplied by tens. Students then review and extend their understanding of the area and partial products models of multiplication. Students build fluency with the Distributive Property of Multiplication and grouping numbers in various ways to support mental math computation. In Concept 2, students develop their understanding of the standard algorithm. They learn not only how to work through the computation, but why. Students use estimation and modeling to support this understanding. They then extend this into application with multistep story problems.

CONCEPT 1

Models for Multiplication

Concept Overview

In Concept 1 Models for Multiplication, students identify and explain the patterns when multiplying by powers of ten. Connecting the patterns to place value and metric system conversion, including the placement of a decimal point, deepens conceptual understanding. Students apply this learning to other models including area and partial products. A major goal is for students to develop fluency and flexibility with their understanding of how numbers work, so students are encouraged to try different combinations in each model and in applying the Distributive Property of Multiplication.

Concept Standards

5.A.1.b Explain patterns in the number of zeros in the product when multiplying a number by powers of 10 (for example, the product of a single digit and 1,000 will have three zeros, while the product of a single digit and 100,000 will have five zeros).

5.A.3.a Fluently multiply multi-digit whole numbers.

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1000.

LESSON 1
The Power of Ten

Lesson Overview

In this lesson, students discover patterns when multiplying by powers of ten. They connect these patterns to their understanding of place value and how the decimal point moves when multiplying. This deeper understanding challenges students to think beyond just noticing that zeros are added to the end of the product. They multiply one-digit numbers by powers of ten, solve real-world powers of ten problems using the metric system as a context for learning, and create expressions to make multiples where one factor is a power of ten.

Lesson Essential Question

- How can we use our understanding of place value to multiply large numbers efficiently?

Lesson Learning Objectives

- Students will identify powers of ten.
- Students will multiply single digits by powers of ten.
- Students can explain the patterns they observe when multiplying by powers of ten.

Grade-Level Standards

5.A.1.b Explain patterns in the number of zeros in the product when multiplying a number by powers of 10 (for example, the product of a single digit and 1,000 will have three zeros, while the product of a single digit and 100,000 will have five zeros).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1000.

COMMON MISCONCEPTIONS AND ERRORS

Students may simply add zeros when multiplying by a power of ten without understanding the underlying mathematical reasoning that multiplying by a power of ten results in a shift in the decimal point.



ACCESS (10 min)

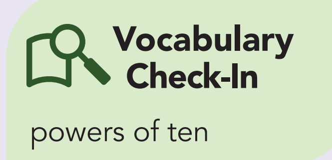
Powers of Ten Patterns

1. Ask students to review Powers of Ten Patterns with their partner and discuss the patterns they see. Ask volunteers to share their thinking with the class. Examples: Each equation is ten times greater than the one before; the product has the same number of zeros as the total number in both factors.

DIGITAL



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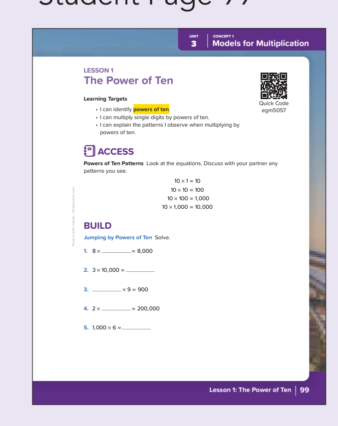
powers of ten

VIDEO LESSON



Quick Code: egmt5058

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UNIT 3 | CONCEPT 1 Models for Multiplication

LESSON 1
The Power of Ten

Learning Targets
- I can identify powers of ten.
- I can multiply single digits by powers of ten.
- I can explain the patterns I observe when multiplying by powers of ten.

Quick Code egm5057

ACCESS

Powers of Ten Patterns Look at the equations. Discuss with your partner any patterns you see.

$10 \times 1 = 10$
$10 \times 10 = 100$
$10 \times 100 = 1,000$
$10 \times 1,000 = 10,000$

BUILD

Jumping by Powers of Ten Solve.

1. $8 \times$ ______ $= 8,000$
2. $3 \times 10,000 =$ ______
3. ______ $\times 9 = 900$
4. $2 \times$ ______ $= 200,000$
5. $1,000 \times 6 =$ ______

Photo Credit: ImAAm / Shutterstock.com

Lesson 1: The Power of Ten | 99

Powers of Ten Patterns
Teacher Note for #1:

The term "power of 10" is used throughout Primary 5 to refer to whole numbers such as 10, 100, and 1,000 and decimals such as 0.1, 0.01, and 0.001. Students are not expected to use exponents. It is important to discuss to difference between powers of 10 (for example, 10 × 10) and multiples of 10 (for example, 2 × 10). Students should focus on the patterns they observe when multiplying and dividing by powers of 10 to further develop their knowledge of place value and their number sense. This helps to build their foundational understanding in preparation for exponents in Primary 6.

2. Explain the difference between multiplying by powers of ten and multiplying by multiples of ten, both in terms of meaning and expression.
3. Ask students to think about whether a power of ten and a multiple of ten could ever be the same number and explain why. All powers of ten are multiples of ten, but not all multiples of ten are powers of ten. For example, 100 is both a power of ten and a multiple of ten but 30 is only a multiple of ten.

BUILD (40 min)




Jumping by Powers of Ten, Matching Expressions, and Multiplying by Powers of Ten

1. Explain that when we multiply a number by a power of ten, we change the place value of each digit in the number. Write 4 on the board and ask students how they would write this number as a decimal. 4.0 Remind students that each place value represents a jump of a power of ten.
2. Write 4.0×10 on the board and ask students to simplify the expression. Ask students how they would write the answer as a decimal number. 40.0
3. Tell students that multiplying by a power of ten means that the decimal moves by a power of ten. In other words, the decimal moves in the number to the next place value. Demonstrate using 4.0×10. Explain that a common error some people make is to just count the zeros and add them to the other factor (for example, $4 \times 100 = 400$). This shortcut does not work with decimal numbers.
4. Write 2×100 and 2.3×100 on the board and ask students to evaluate both products. 200; 230
5. Explain that although it is possible to add two zeros to 2 when multiplying it by 100, that shortcut does not work with 2.3×100. They must move the decimal two places to the right to increase the value of 2.3 one hundred times. If needed, draw jumps under the decimal and count by powers of ten to show the increase in value.
6. Explain that today's lesson focuses on multiplying whole numbers by powers of ten. The decimal example is to help students understand how multiplying by powers of ten changes place value. Ask students to complete all the problems. Go over answers together. Ask students to share strategies they used and model any problems that confused them.

Answer Key for Jumping by Powers of Ten

1. 1,000
2. 30,000
3. 100
4. 100,000
5. 6,000

Answer Key for Matching Expressions

A. $5 \times 10{,}000$ **B.** 5×100 **C.** $5 \times 1{,}000$ **D.** 10×5 **E.** $100{,}000 \times 5$

Answer Key for Multiplying by Powers of Ten

1. 9,000 kg

2. 70 mm

3. 2,000 mL

4. 5,000 m

Student Page 101





CONNECT (7 min)



Writing About Math

Ask students to respond to the question independently.

Answer Key for Writing About Math

Answers may vary. Sample answer: Powers of ten are numbers like 10, 100, and 1,000. Multiples of ten are numbers like 20, 30, and 40. All powers of ten are multiples of ten, but all multiples of ten are not powers of ten.

WRAP-UP (3 min)





Let's Chat About Our Learning

Ask students to share their responses to the CONNECT question. Give students an opportunity to ask each other questions and clear up misconceptions.

PRACTICE

1. $7 \times 1{,}000 = 7{,}000$ or $1{,}000 \times 7 = 7{,}000$

2. $2 \times 100 = 200$ or $100 \times 2 = 200$

3. $4 \times 10 = 40$ or $10 \times 4 = 40$

4. $5 \times 10{,}000 = 50{,}000$ or $10{,}000 \times 5 = 50{,}000$

5. $3 \times 100{,}000 = 300{,}000$ or $100{,}000 \times 3 = 300{,}000$

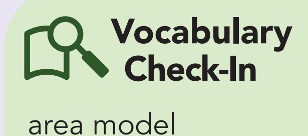
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Material List

- Large copy of Area Model of Multiplication Anchor Chart Blackline Master



area model

VIDEO LESSON



Quick Code: egmt5060

LESSON 2
Using the Area Model to Multiply

Lesson Overview

In this lesson, students review how to use expanded form in the area model of multiplication. This work is extended to encourage students to decompose the factors using strategies other than expanded form, which may not be the most efficient method. This promotes flexible thinking in students and personal ownership of their work. Students learn that they can decompose problems to make them easier to solve mentally or into different factors that are easier for them to multiply.

Lesson Essential Questions

- How can we use our understanding of place value to multiply large numbers efficiently?
- How do mathematicians use models to make sense of problems?

Lesson Learning Objective

- Students will multiply using the area model.

Grade-Level Standard

5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- When using the area model, students may struggle to determine how to break the two factors into expanded form and may also fail to recognize how to record a place value with a zero.
- Students may not place the correct product in the correct spot when using the area model.



ACCESS (10 min) 

Fast Fact Check-In, Writing Expressions, and Multiplying Tens

Ask students to complete as many problems as they can in eight minutes. Use the remaining time to check answers and discuss Multiplying Tens.

Answer Key for Fast Fact Check-In

1. 5,000
2. 40
3. 7,000
4. 8
5. 1,000

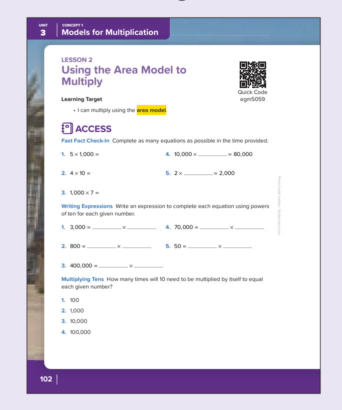
Answer Key for Writing Expressions

1. $3 \times 1{,}000$ or $1{,}000 \times 3$
2. 8×100 or 100×8
3. $4 \times 100{,}000$ or $100{,}000 \times 4$
4. $7 \times 10{,}000$ or $10{,}000 \times 7$
5. 5×10 or 10×5

Answer Key for Multiplying Tens

1. 2
2. 3
3. 4
4. 5

Student Page 102

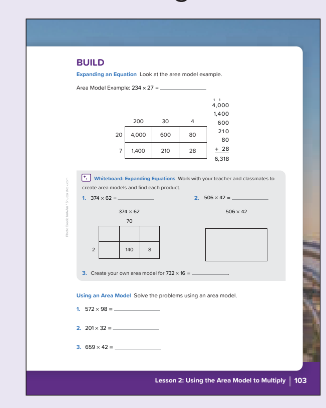


BUILD (40 min) 

Expanding an Equation (5 min)

1. Write 234×27 on the board. Ask students if it is easier to think of this problem as 234 groups of 27 or 27 groups of 234. Ask students to picture both equations in their heads. Review the area model using the Area Model of Multiplication Anchor Chart.

Student Page 103



2. Point out the example problem of 234×27 in this section. Ask students to think about how the problem is related to powers of ten. How can they use what they learned in Lesson 1 to fill in the area model? Students should see that they can multiply factors such as 200×20 by multiplying the 2s and then adding on the zeros. This connects to powers of ten because the problem could also be written as $(2 \times 2) \times (10 \times 100)$.

3. Ask students to think about the model and how they might have to draw it differently if different numbers were being multiplied. The number of columns and rows depends on the number of digits in the factors multiplied.

Whiteboard: Expanding Equations (5 min)

Ask students to work independently or in pairs to complete the problems. Go over the answers together. In the second problem, remind students to pay attention to place value when they have a zero in the factor. Check to see if students applied their understanding of powers of ten in the last problem.

Answer Key for Whiteboard: Expanding Equations

1. 23,188

374×62

	300	70	4
60	18,000	4,200	240
2	600	140	8

$$\begin{array}{r} {}^{11}\\ 18{,}000 \\ 4{,}200 \\ 240 \\ 600 \\ 140 \\ +\quad 8 \\ \hline 23{,}188 \end{array}$$

2. 21,252

506×42

	500	0	6
40	20,000	0	240
2	1,000	0	12

$$\begin{array}{r} 20{,}000 \\ 1{,}000 \\ 240 \\ +\quad 12 \\ \hline 21{,}252 \end{array}$$

3. 11,712

732 × 16

	700	30	2
10	7,000	300	20
6	4,200	180	12

7,000
4,200
300
180
20
+ 12
11,712

Using an Area Model (10 min)

Ask students to work independently or in pairs to complete Problems 1 to 6. Go over the answers together. Check to see if students applied their understanding of powers of ten in Problem 6.

Answer Key for Using an Area Model

1. 56,056

572 × 98

	500	70	2
90	45,000	6,300	180
8	4,000	560	16

45,000
6,300
180
4,000
560
+ 16
56,056

2. 6,432

201 × 32

	200	0	1
30	6,000	0	30
2	400	0	2

6,000
400
30
+ 2
6,432

3. 27,678

659 × 42

	600	50	9
40	24,000	2,000	360
2	1,200	100	18

24,000
2,000
360
1,200
100
+ 18
27,678

4. 56,984

3,352 × 17

	3,000	300	50	2
10	30,000	3,000	500	20
7	21,000	2,100	350	14

30,000
21,000
3,000
2,100
500
350
20
+ 14
56,984

5. 1,122 km

187 × 6

	100	80	7
6	600	480	42

600
480
+ 42
1,122

6. 11,220 km

187 × 60

	100	80	7
60	6,000	4,800	420
0	0	0	0

6,000
4,800
+ 420
11,220

Decompose with Area Model (5 min)

1. Tell students that the area model with place value is a strategy mathematicians use, but there are other strategies. Numbers can be decomposed in many ways to make problems easier for the mathematician.



- *Ask students to read the problem and create their own models to find the product. Call on students to share how they decomposed the numbers and draw their models on the board. Ask questions to gauge understanding, such as: Does it matter which factor goes on the top of the model or the algorithm? No. The order does not matter in multiplication.*
- *How many different ways can you decompose the length? The width? Accept all accurate answers.*
- *Explain the best way for you to split the area into parts. How does this help your thinking? Answers will vary. Students may describe decomposing the problem into math facts with which they are fluent.*

2. Tell students that because the area model is a flexible tool, they can decompose numbers in a way that makes it easier for them to solve. For example, 60 could be split into 20 + 20 + 20 if a student is more comfortable with their 2s multiplication facts or if that helps facilitate their mental math.

Area Model Decomposed (15 min)

Ask students to complete Problems 1 through 5. Students should decompose the numbers using a strategy other than expanded form. Go over the answers together and ask students to share and explain their strategies.

Answer Key for Area Model Decomposed

1. Accept all accurate models; 2,232
2. Accept all accurate models; 893
3. Accept all accurate models; 5,049
4. Accept all accurate models; 16,590
5. Accept all accurate models; 10,788



CONNECT (7 min)



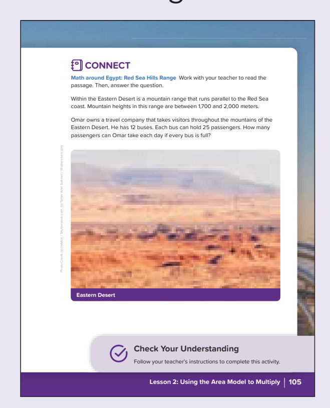
Math around Egypt: Red Sea Hills Range

Work with students to read the passage. Then, ask them to respond to the question.

Answer Key for Math around Egypt: Red Sea Hills Range

300 passengers (or 300)

Student Page 105



WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their answers to the CONNECT problem and the strategy they used to solve it. Ask students to discuss the most effective and efficient decomposition for them.

PRACTICE

1. Accept all accurate models; 51,576
2. Accept all accurate models; 133,760
3. Accept all accurate models; 10,140
4. Mrs. Hasnaa's class read 37,668 pages and Mrs. Muhamad's class read 37,125 pages. Mrs. Hasnaa's class read more pages.

LESSON 3
The Distributive Property of Multiplication

Lesson Overview

In this lesson, students use the area model to build understanding of the Distributive Property of Multiplication. Students write and solve equations in the area model and use parentheses to apply the Distributive Property. Students continue to decompose numbers in different ways in order to develop flexible mathematical thinking.

Lesson Essential Questions

- How can we use our understanding of place value to multiply large numbers efficiently?
- How do mathematicians use models to make sense of problems?

Lesson Learning Objective

- Students will explain the relationship between the area model of multiplication and the Distributive Property of Multiplication.

Grade-Level Standard

5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to write an equation that matches an area model.
- Students may not understand the connection between breaking factors into smaller parts and the Distributive Property of Multiplication.

ACCESS (10 min)



Error Analysis

Ask students to read the problem and complete the error analysis. Go over the answers together.

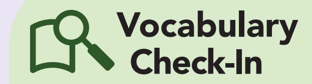
Answer Key for Error Analysis

1. Badir correctly wrote 45 in expanded form in the area model and correctly wrote 200. His multiplication and addition in the model are also correct.
2. Badir did not write 206 in expanded form in the model. He did not leave the number in the Tens place as a zero. Instead, he moved the 6 to the Tens place, making the number 60 instead of 6.

DIGITAL



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Vocabulary Check-In

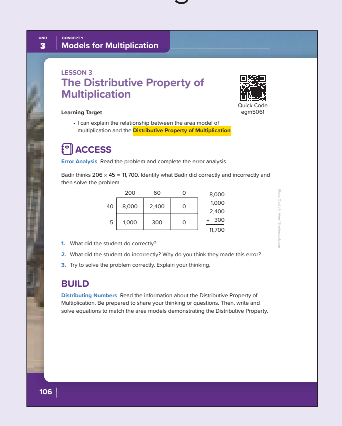
Distributive Property of Multiplication

VIDEO LESSON



Quick Code: egmt5062

Student Page 106



UNIT 3 | CONCEPT 1 Models for Multiplication

LESSON 3
The Distributive Property of Multiplication

Quick Code egm5061

Learning Target

- I can explain the relationship between the area model of multiplication and the Distributive Property of Multiplication.

ACCESS

Error Analysis Read the problem and complete the error analysis.

Badir thinks $206 \times 45 = 11,700$. Identify what Badir did correctly and incorrectly and then solve the problem.

	200	60	0
40	8,000	2,400	0
5	1,000	300	0

8,000
1,000
2,400
+ 300
11,700

1. What did the student do correctly?
2. What did the student do incorrectly? Why do you think they made this error?
3. Try to solve the problem correctly. Explain your thinking.

BUILD

Distributing Numbers Read the information about the Distributive Property of Multiplication. Be prepared to share your thinking or questions. Then, write and solve equations to match the area models demonstrating the Distributive Property.

Photo Credit: ImAAm / Shutterstock.com

106

3. The correct answer is 9,270. Explanations and models may vary.

	200	0	6
40	8,000	0	240
5	1,000	0	30

$$\begin{array}{r} 8{,}000 \\ 1{,}000 \\ 240 \\ +\ 30 \\ \hline 9{,}270 \end{array}$$

BUILD (40 min) 

Distributing Numbers (20 min)

1. Discuss the model of the Distributive Property of Multiplication shown in the Student Materials. Work with students to solve Problem 1.

2. Ask students to complete Problems 2 to 5. and then check the answers as a class. Make sure students understand that it is because of the Commutative Property that they may have different ways of writing the order of the equations.

Answer Key for Distributing Numbers

1. $(40 \times 50) + (40 \times 8) + (2 \times 50) + (2 \times 8) = 2{,}436$
2. $(20 \times 30) + (20 \times 7) + (30 \times 4) + (4 \times 7) = 888$
3. $(20 \times 60) + (20 \times 3) + (9 \times 60) + (9 \times 3) = 1{,}827$
4. $(30 \times 40) + (30 \times 7) + (9 \times 40) + (9 \times 7) = 1{,}833$
5.

	40	8
40	1,600	320
9	360	72

2,352

Flexible Numbers (20 min)

1. Write 7×6 on the board and discuss how this fact can be broken into smaller facts. $(7 \times 5) + (7 \times 1)$. Show students how 24×15 can be decomposed as $(24 \times 10) + (24 \times 5)$ and $(20 \times 10) + (4 \times 10) + (20 \times 5) + (4 \times 5)$. Emphasize the concept that no matter how the factors are distributed, the product is always the same.

2. Tell students it is because of the Distributive Property that these numbers can be broken down into smaller facts (as in Lesson 2).

3. Remind students that, although we frequently use expanded form to decompose numbers in area models, good mathematicians are flexible with their thinking.
4. Write $26 \times 15 =$ _____ on the board and ask students to discuss with their partners how they could decompose the numbers in the equation to make it easier to solve. Call on students to share their thinking.
5. Ask students to complete Problem 1. Go over the models and answers together and ask students to discuss which strategy they would use and why. Ask students to solve Problems 2 and 3 (independently or with a partner). Go over the answers together.

Answer Key for Flexible Numbers

1. Mazen: 1,162

	40	40	3
10	400	400	30
4	160	160	12

Lamiaa: 1,162

	80	3
7	560	21
7	560	21

Reeda: 1,162

	80	3
10	800	30
4	320	12

2. $(20 \times 30) + (20 \times 3) + (6 \times 30) + (6 \times 3) = 858$

	30	3
20	600	60
6	180	18

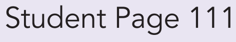
$(20 \times 20) + (20 \times 10) + (20 \times 3) + (6 \times 20) + (6 \times 10) + (6 \times 3) = 858$

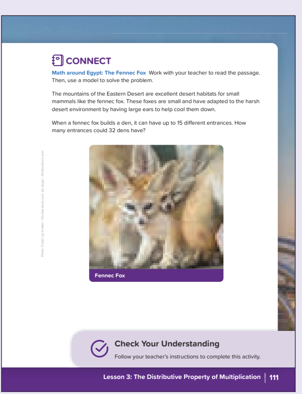
	20	10	3
20	400	200	60
6	120	60	18

$(11\times10)+(11\times10)+(11\times6)+(11\times10)+(11\times10)+(11\times6)+(11\times10)+(11\times10)+(11\times6)=858$

	11	11	11
10	110	110	110
10	110	110	110
6	66	66	66

3. Models will vary; 1,428


Student Page 111





CONNECT (7 min)



Math around Egypt: The Fennec Fox

Work with students to read the passage. Then, have students respond to the question.

Answer Key for Math around Egypt: The Fennec Fox

480 entrances

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their answers to the CONNECT problem. Encourage students to describe their problem-solving strategies and ask each other questions.

PRACTICE

1. 90; 7; 6,231
2. Equations should include $(10\times40)+(10\times4)+(8\times40)+(8\times4)=792$
3. A, C, E
4. Equation should include the numbers in the selected model; answers should be accurate for the selected model.
5. Equation should include the numbers in the model that was created; 2,146

LESSON 4
Using the Partial Products Model to Multiply

Lesson Overview

In this lesson, students estimate products and discuss strategies for estimation as a way to check the reasonableness of their answers. Then, they review and practice the partial products model for multiplication, linking it to previous work with the area model. This lesson is intended to provide another way for students to think flexibly about how to solve multi-digit multiplication and provide a scaffold for the standard algorithm in Lesson 5.

Lesson Essential Question

- How can we use our understanding of place value to multiply large numbers efficiently?

Lesson Learning Objectives

- Students will multiply using the partial products model.
- Students will estimate products.

Grade-Level Standard

5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not find the correct number of partial products.
- Students may not correctly add the partial products to find the total product.



ACCESS (10 min)



Estimating Products

Ask students to estimate the products and then discuss with a partner. Discuss responses together. Emphasize that estimation is a tool to help get a rough calculation of the product and to check the reasonableness of answers.

Answer Key for Estimating Products

Strategies may include front end estimation or rounding.

Possible answers include:

1. $30 \times 50 = 1{,}500$; $30 \times 60 = 1{,}800$
2. $100 \times 70 = 7{,}000$; $200 \times 80 = 16{,}000$

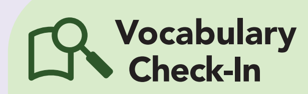
DIGITAL



Quick Code: egmt5063

Materials List

- Digit cards (1 set per pair of students)
- Graph paper (1 to 2 sheets per pair of students)
- Large copy of Partial Products Anchor Chart Blackline Master
- Large copy of Bow-Tie Strategy Anchor Chart Blackline Master



Vocabulary Check-In

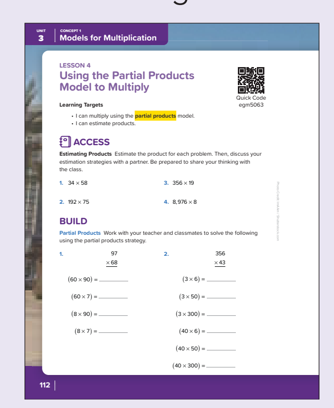
Commutative Property of Multiplication, partial products model

VIDEO LESSON



Quick Code: egmt5064

Student Page 112



3. $300 \times 10 = 3{,}000$; $400 \times 20 = 8{,}000$

4. $8{,}000 \times 8 = 64{,}000$; $9{,}000 \times 8 = 72{,}000$

BUILD (40 min) 

Partial Products (20 min)

1. Ask for a volunteer to model how to solve 56 × 38 using the area model, decomposing the numbers by place value. Discuss how many partial products this two-digit by two-digit multiplication problem has. 4
2. Ask students to hold up the number of fingers to show how many partial products 234 × 67 would have and ask for a volunteer to explain using the Distributive Property. 6; (200 × 60) + (200 × 7) + (30 × 60) + (30 × 7) + (4 × 60) + (4 × 7)
3. Explain that the area model is a strategy mathematicians use to multiply large numbers in chunks, but another strategy is the partial products model. Ask students to share what they remember. Reinforce accurate ideas.
4. Discuss the Partial Products Anchor Chart as a group and ask students to discuss with a partner how the model is similar to the area model. The number of products is the same using the partial products and the area model, as long as the area model is decomposed by place value. If time allows, discuss how it would differ if students decomposed differently than by place value.
5. Work with students to solve Problems 1 and 2. Encourage students to share their thinking. (Each partial product is recorded within parentheses to support the work that was done in Lesson 3.)

Discuss:



- *Does the order of the products matter? No, because of the Commutative Property of Multiplication. It is recommended that within a single problem students maintain the same order just to help organize their thinking.*
- *How can you be sure you have all the products listed? A two by two has 4 products, a three by two has 6 products, and so on. The number of products is the number of digits in the first factor times the number of digits in the second factor. Another option is to use a "bow-tie" strategy, crossing off each factor as it is multiplied.*
- *How can you make sure that you add all the partial products correctly? Lining up the products according to their place value ensures a correct final sum. Graph paper can help.*

Answer Key for Partial Products

1.

	97
	× 68
(60 × 90) =	5,400
(60 × 7) =	420
(8 × 90) =	720
(8 × 7) =	56
	6,596

2.

	356
	× 43
(3 × 6) =	18
(3 × 50) =	150
(3 × 300) =	900
(40 × 6) =	240
(40 × 50) =	2,000
(40 × 300) =	12,000
	15,308

Partial Products Game (20 min)

1. Go over the directions for the Partial Products Game and discuss the example.

   Directions

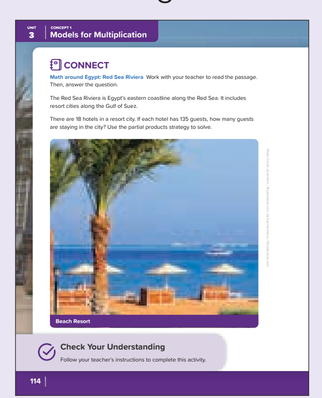
   - Each player picks four or five cards depending on the teacher's direction.
   - Each player creates two 2-digit numbers *or* one 3-digit number and one 2-digit number and records the numbers.
   - Players estimate the product and record their own estimate.
   - Players solve their own problems using the partial products strategy.
   - The player closest to their estimate gets one point.

2. Play one round against the class to model game play. Use four cards, creating two 2-digit numbers. Ask for estimates. Then, evaluate the product and discuss who is closer. Ask students to share the strategies they used to determine who earned the point.

3. Put students into pairs and have them play. Students who are struggling should play with four cards; consider having those students play in a group or with you. Have graph paper available to help students who may need it to line up products and organize their thinking.

4. With a few minutes left, ask students to discuss strategies for estimation as well as understanding of the partial products method.

Student Page 114





CONNECT (7 min)

Math around Egypt: Red Sea Riviera

Work with students to read the passage. Then, have students respond to the question.

Answer Key for Math around Egypt: Red Sea Riviera

2,430 guests

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to talk to their Shoulder Partner about one of the Concept Essential Questions. Use Calling Sticks to select students to share their thinking with the class.

- How can we use our understanding of place value to multiply large numbers efficiently?
- How do mathematicians use models to make sense of problems?

Place value helps mathematicians decompose numbers into smaller chunks which makes multiplication easier. Understanding place value ensures that the final product has a correct value. Models help mathematicians to visually understand what is happening and to show how numbers are decomposed into different parts and then composed into a final product.

PRACTICE

1. 40; 560; 4,800; 200; 2,800; 24,000; Total = 32,400
2. B
3. 7,905
4. (40×60); (40×8); (5×60); (5×8); Total: 3,060
5. B

CONCEPT CHECK-IN AND REMEDIATION
Models for Multiplication

DIGITAL



Quick Code: egmt5065

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Models for Multiplication. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- How can we use our understanding of place value to multiply large numbers efficiently?
- How do mathematicians use models to make sense of problems?

Lesson Learning Objective

- Students will correct misconceptions and errors related to conceptual models for multiplication.

Student Learning Target

- I can correct misconceptions and errors related to conceptual models for multiplication.

Grade-Level Standards

5.A.1.b Explain patterns in the number of zeros in the product when multiplying a number by powers of ten (for example, the product of a single digit and 1,000 will have three zeros, while the product of a single digit and 100,000 will have five zeros).

5.A.3.a Fluently multiply multi-digit whole numbers.

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1000.

COMMON MISCONCEPTIONS AND ERRORS

- Students may simply add zeros when multiplying by a power of ten without understanding the underlying mathematical reasoning that multiplying by a power of ten results in a shift in the decimal point.
- When using the area model, students may struggle to determine how to break the two factors into expanded form and may also fail to recognize how to record a place value with a zero.
- Students may not place the correct product in the correct spot when using the area model.
- Students may struggle to write an equation that matches an area model.
- Students may not understand the connection between breaking factors into smaller parts and the Distributive Property of Multiplication.
- Students may not find the correct number of partial products.
- Students may not correctly add the partial products to find the total product.

Remediation: Correcting Misconceptions

If . . .	**Then . . .**
Students simply add zeros when multiplying by a power of ten rather than understanding the underlying mathematical reasoning that multiplying by a power of ten indicates a shift in the decimal point.	Review Lesson 1 and practice multiplying decimal numbers by powers of ten. Ask students to practice drawing "jumps" under the number as they move the decimal and count by 10s.
If . . . When using the area model, students struggle to determine how to break the two factors into expanded form or fail to recognize how to record a place value with a zero. **Or . . .** Students do not place the correct product in the correct spot when using the area model.	**Then . . .** Review Lesson 2 and practice making more area models. Students can also put addition symbols in between the addends on the sides of the model to help them remember it needs to add up to the factors. Students can practice breaking apart area models in different ways. **And . . .** Students can practice drawing faint lines that connect the factors being multiplied in their models, so they know where to place them and which numbers to multiply.
If . . . Students struggle to write an equation that matches the area model. **Or . . .** Students do not understand the connection between breaking factors into smaller parts and the Distributive Property.	**Then . . .** Review Lesson 3 and practice these skills with additional scaffolded area models and equations where students supply only some of the numbers. **And . . .** Students can slowly work toward more independence.

If . . .	Then . . .
Students do not correctly add the partial products to find a total product of the two original factors.	Review Lesson 4 and supply graph paper for students to line up numbers by place value and ensure that they are adding Ones to Ones and Tens to Tens, and so on.
If . . .	**Then . . .**
Students struggle to find the correct number of partial products, forgetting a digit or part of a factor.	Review Lesson 4 asking them to determine the number of products before they begin, similar to the lesson discussion. Also, have them use the bow-tie method to see how many partial products they will find and need to add for the final product.



CONCEPT 2

Multiplying 4-Digit Numbers by 2-Digit Numbers

Concept Overview

In Concept 2 Multiplying 4-Digit Numbers by 2-Digit Numbers, students solidify their understanding of the standard algorithm for multiplication. They multiply 4-digit by 2-digit numbers and connect the algorithm to place value. Ultimately, students should develop fluency or the ability to accurately and effectively multiply multi-digit numbers. The final lesson of the concept and unit asks students to apply their understanding of multiplication in real-world contexts.

Concept Standards

5.A.3.a Fluently multiply multi-digit whole numbers.

Photo Credit: Reinholds Nulle / Shutterstock.com

LESSON 5
What Is an Algorithm?

Lesson Overview

In this lesson, students connect powers of ten and multiplication with mental math practice as they continue to look for patterns in mathematics and build fluency and number sense. Students review and practice the standard algorithm for multiplication, which was introduced in Primary 4. They explore the relationship between the area model, partial products model, and the standard algorithm. The goal is for students to gain a deeper understanding of why the standard algorithm is an accurate and efficient strategy.

Lesson Essential Question

- How can models help mathematicians understand how and why algorithms work?

Lesson Learning Objective

- Students will multiply using the standard algorithm.

Grade-Level Standard

5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to see the relationship between the partial products model for multiplication and the standard algorithm.
- When using the standard algorithm for multi-digit numbers, students sometimes ignore place value.





Mental Math

Ask students to solve Problems 1 to 3 with a partner. Ask students to share their answers and their observations, particularly with regard to Problem 3.

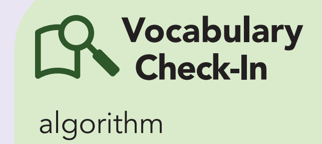
Answer Key for Mental Math

1. 350; 2,500; 75,000
2. 315; 2,475
3. When a factor is close to a power of ten, you can multiply by the power of ten and then subtract the other factor.

DIGITAL



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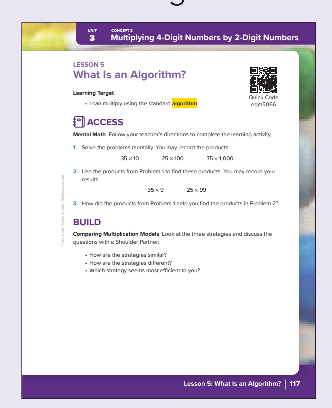
algorithm

VIDEO LESSON



Quick Code: egmt5067

Student Page 117



BUILD (40 min) 

Comparing Multiplication Models
Teacher Note for #1:

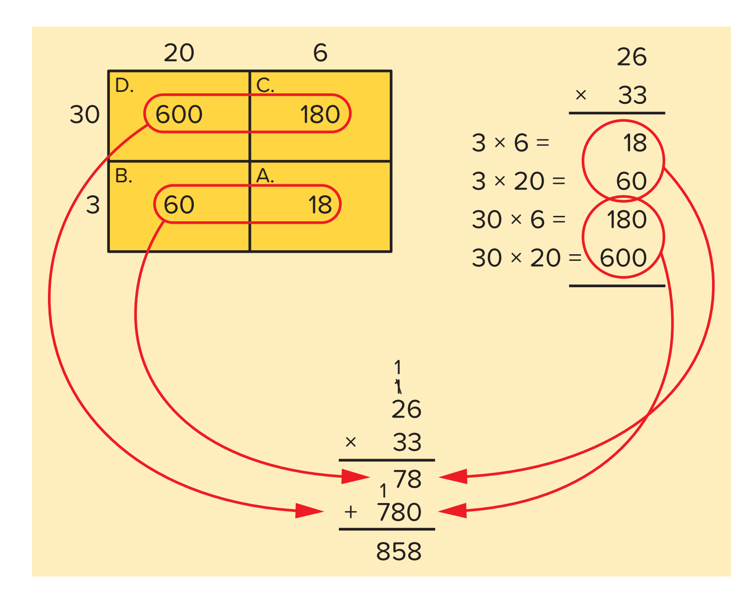
The standard algorithm for multiplication was taught in Primary 4. Use this as an opportunity to gauge what students remember about the standard algorithm for multiplication. If needed, remind students that the standard algorithm is a procedural way mathematicians solve any operation. The multiplication algorithm combines the area and partial products models to create an efficient and accurate procedure.

Comparing Multiplication Models (10 min)

1. Ask students to share what they know about the standard algorithm for multiplication. Accept all reasonable answers. Take note of misconceptions and errors so they can be corrected during the lesson.
2. Ask students to discuss the models with a partner. Then, ask volunteers to share their conversations. Explain that today's goal is to review and practice the standard algorithm by linking it to the multiplication models learned in previous lessons.
3. Ask volunteers to read the bullets under "How does the standard algorithm work?" Discuss the importance of remembering place value and provide examples as needed.

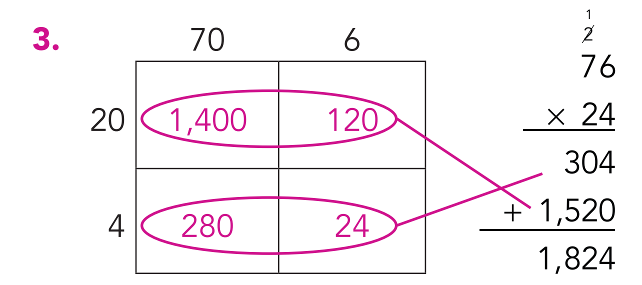
Standard Multiplication Algorithm (30 min)

1. Ask students to solve Problems 1 and 2. Then, ask students to discuss the similarities they observed between the answers to both problems.
2. Work with students to solve 26×33 using the standard algorithm. Ask students to verbalize each step, taking care to state the place values involved each time.
3. Call on volunteers to explain their thinking. To reinforce, loop the products to give students a visual connection and help make sense of the algorithm. Example shown.



4. Ask students to solve Problems 3 to 7 (independently or with a partner). If some students are struggling, work with them in a small group to provide additional instruction and support. Go over the answers together.

Answer Key for Standard Multiplication Algorithm

1. A. 18; B. 60; C. 180; D. 600; E. 858
2. 18; 60; 180; 600; 858
3. 

   The bottom row of the area model matches the first part of the addition step. The top row of the area model matches the second part of the addition step.
4. A. 4; B. 0; C. 5,092
5. 6,232
6. 12,402
7. Akram is correct. Seventy 34s minus one 34 is the same as sixty-nine 34s.

CONNECT (7 min)

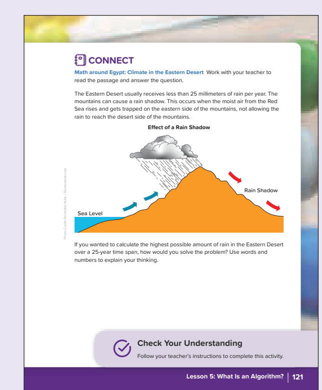
Math around Egypt: Climate in the Eastern Desert

Work with students to read the passage. Then, have students respond to the question.

Answer Key for Math around Egypt: Climate in the Eastern Desert

Students should recognize that they should multiply to find the answer. Examples and multiplication strategies may vary.

Student Page 121



WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students: *What are some things to pay attention to when using the standard algorithm?*

Answers may include the following: Start with the Ones. If the product is more than 10, regroup. When multiplying the digit in the Tens place, remember to include a zero in the Ones place. Cross out any numbers that were regrouped when multiplying by the Ones to help ease confusion. Use place value to properly line up products to help ensure your addition is correct.

PRACTICE

1. 2,184
2. 3,430
3. 22,230
4. Sara
5. C

LESSON 6
Multiplying Multi-Digit Numbers

Lesson Overview

In this lesson, students begin with an error analysis to review the standard algorithm. Then, students explore what adding a fourth digit to one of the factors does to the final product. They multiply 4-digit numbers by 2-digit numbers and compare their final product to an estimated product to check the reasonableness of their answers.

Lesson Essential Question

- How can models help mathematicians understand how and why algorithms work?

Lesson Learning Objectives

- Students will multiply 4-digit numbers by 2-digit numbers using the standard algorithm.
- Students will use estimation to check the reasonableness of their answers.

Grade-Level Standard

5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- When using the standard algorithm for multi-digit numbers, students may ignore place value.
- Students may struggle when another digit is added to one of the factors.





Error Analysis

Ask students to complete the error analysis. Go over the answers together.

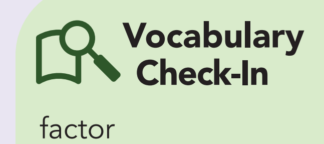
Answer Key for Error Analysis

1. Ashraf correctly multiplied 357×6. He also added his two products correctly (even though the bottom product was incorrect).
2. Ashraf multiplied 3×7 and wrote the entire product. He did not realize that the 2 must be regrouped. He did not realize that the 3 has a value of 30 and did not put a zero in the Ones place.
3. 12,852. Explanations will vary.

DIGITAL



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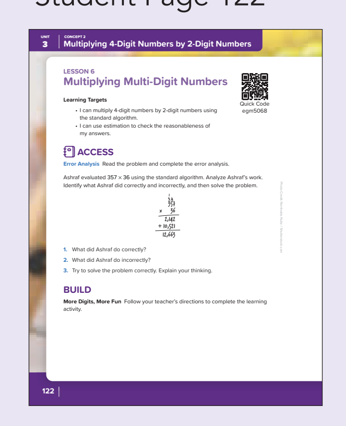
factor

VIDEO LESSON



Quick Code:
egmt5069

Student Page 122


UNIT 3 | CONCEPT 2 Multiplying 4-Digit Numbers by 2-Digit Numbers

LESSON 6
Multiplying Multi-Digit Numbers

Quick Code
egm5068

Learning Targets

- I can multiply 4-digit numbers by 2-digit numbers using the standard algorithm.
- I can use estimation to check the reasonableness of my answers.

ACCESS

Error Analysis Read the problem and complete the error analysis.

Ashraf evaluated 357 × 36 using the standard algorithm. Analyze Ashraf's work. Identify what Ashraf did correctly and incorrectly, and then solve the problem.

$$\begin{array}{r} 357 \\ \times\ 36 \\ \hline 2{,}142 \\ +\ 10{,}521 \\ \hline 12{,}663 \end{array}$$

1. What did Ashraf do correctly?
2. What did Ashraf do incorrectly?
3. Try to solve the problem correctly. Explain your thinking.

BUILD

More Digits, More Fun Follow your teacher's directions to complete the learning activity.

Photo Credit: Reinhold Nuile / Shutterstock.com

122

BUILD (40 min)



More Digits, More Fun (20 min)

1. Record $4{,}315 \times 83 =$ _____ and ask students:



- *How is this problem different from the problem in ACCESS? One of the factors has 4 digits.*
- *Does the presence of a fourth digit change how we multiply? How does it change the area model, partial products model, and the standard algorithm? Area model: We must add one more row or column; Partial products model: There are two more partial products; Standard algorithm: We will do the same thing. We just have one more digit to multiply.*

2. Ask students to share an estimate for the product. Record several estimates. Estimates will vary.
3. Ask students to solve the problem with a Shoulder Partner. One student should use either the partial products model or the area model. The other should use the standard algorithm. Once finished, ask students to explain their process to each other.
4. Return to the list of estimated products and ask students to compare any of the estimates with the actual answer.
5. Record $4{,}305 \times 83 =$ _____ and ask students:



- *How is this problem different from the first one? There is a 0 in the Tens place instead of a 1.*
- *How many fewer groups of 83 will the product of the new problem contain? Ten fewer groups of 83.*
- *How will that affect the area model, the partial products model, and the standard algorithm? Area model: There will be no row or column for the zero; Partial products model: There are only six partial products; Standard algorithm: There is one less digit to multiply.*

6. Ask students to swap strategies and solve the new problem with their Shoulder Partner. Compare answers and see if the actual product is reasonable based on the estimates.

Match the Model (20 min)

Go over the directions for the learning activity. Make sure students understand there are three steps for each multiplication problem. Give students time to work, and then go over the answers together.

Answer Key for Match the Models

1. Estimates may be between 60,000 and 80,000.; 85,608; A
2. Estimates may be between 140,000 and 210,000.; 186,554; F
3. Estimates may be between 400,000 and 410,000.; 435,766; D
4. Estimates may be between 180,000 and 186,000.; 204,897; C




CONNECT (7 min)

Writing About Math

Ask students to respond to the prompt.

Answer Key for Writing About Math

Answers will vary.

WRAP-UP (3 min)



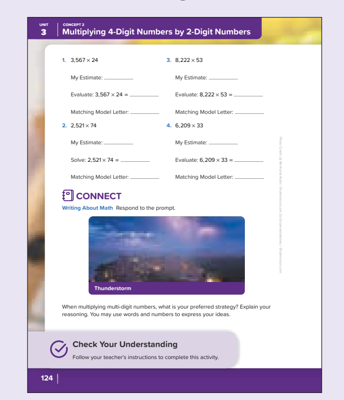
Let's Chat About Our Learning

Ask for volunteers to share their responses to the CONNECT question. Encourage students to ask each other questions and build on each other's ideas.

PRACTICE

1. 30,935
2. 71,850
3. 8,748 m
4. A and C
5. 249,375

Student Page 124



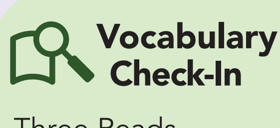
Let's Chat About Our Learning
Teacher Note:

As students share, listen for their reasoning. This can serve as a formative assessment. While the standard algorithm is often the most efficient, some students may prefer to use the area or partial products models and may be more efficient using those strategies right now. Provide ongoing practice and support to students as they build fluency with the standard algorithm.

DIGITAL



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Vocabulary Check-In

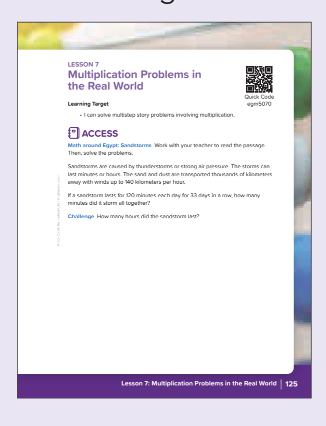
Three Reads Strategy

VIDEO LESSON



Quick Code:
egmt5071

Student Page 125



LESSON 7
Multiplication Problems in the Real World

Quick Code
egm5070

Learning Target

- I can solve multistep story problems involving multiplication.

ACCESS

Math around Egypt: Sandstorms Work with your teacher to read the passage. Then, solve the problems.

Sandstorms are caused by thunderstorms or strong air pressure. The storms can last minutes or hours. The sand and dust are transported thousands of kilometers away with winds up to 140 kilometers per hour.

If a sandstorm lasts for 120 minutes each day for 33 days in a row, how many minutes did it storm all together?

Challenge How many hours did the sandstorm last?

LESSON 7
Multiplication Problems in the Real World

Lesson Overview

In this lesson, students review the Three Reads problem-solving strategy and apply it in order to solve multistep multiplication story problems. Students practice and share different multiplication strategies they have learned throughout Unit 3.

Lesson Essential Question

- How can models help mathematicians understand how and why algorithms work?

Lesson Learning Objective

- Students will solve multistep story problems involving multiplication.

Grade-Level Standard

5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to understand what the story problem is asking them to do.
- Students may not be able to discern the steps necessary to solve a multistep story problem.



ACCESS (10 min)



Math around Egypt: Sandstorms

Work with students to read the passage. Ask students to respond to the questions and then discuss the answers together.

Answer Key for Math around Egypt: Sandstorms

3,960 min

Challenge 66 hr

BUILD (40 min) 

Mona's Restaurant

1. Ask students what they remember about the Three Reads problem-solving strategy. If necessary, review the strategy—First read: Read for understanding; Second read: Read to think about the numbers in the problem and what they mean; Third read: Read to think about what the question is asking. Explain that the Three Reads Strategy can help us solve multistep problems. Multistep problems may involve more than one operation, so it is important to understand what is happening in the problem.
2. Work with students to read the passage and Problem 1. Ask students to work with a partner to solve the problem.
3. Call on students to share their answers and the strategies they used to solve the problem. On the board, record their thinking and the multiplication strategies they used.
4. Ask students to work with a partner using the Three Reads Strategy to solve Problems 2 to 5. Go over the answers together. If necessary, ask volunteers to model how to solve problems that were challenging for the class.

Answer Key for Mona's Restaurant

1. 95,865 g
2. 9,180 g
3. 5,310 mL
4. 2,800 g; 86,400 mL; 86.4 L
5. 17,520 lemons; 2,920 L; 237,930 g



CONNECT (7 min) 

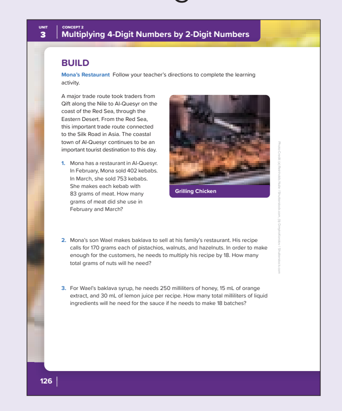
Writing About Math

Ask students to respond to the CONNECT prompt.

Answer Key for Writing About Math

Answers will vary.

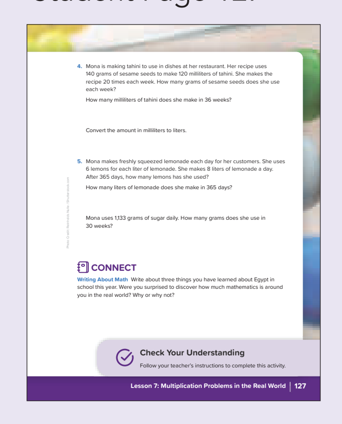
Student Page 126



Mona's Restaurant Teacher Note for #1:

The problems in BUILD, Practice, and Check Your Understanding are challenging. Consider working with students to solve the BUILD problems so you can do Think Alouds to model how to think when solving multistep problems. Encourage students to do Think Alouds to model their problem-solving strategies.

Student Page 127



WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to talk to their Shoulder Partner to answer the Essential Question: *How can models help mathematicians understand how and why algorithms work?* Use Calling Sticks to select students to share their thinking with the class. Models break complex processes into smaller steps to help us see what is happening when we solve problems. Models provide a visual reference for mathematical processes. Models can help us connect mathematical concepts and skills, such as place value, mental math, multiplication facts, and multiplication strategies.

PRACTICE

1. 14,600 bottles
2. 18,048 g
3. 1,278 eggs; 66,456 eggs
4. 97,920 eggs

CONCEPT CHECK-IN AND REMEDIATION
Multiplying 4-Digit Numbers by 2-Digit Numbers

DIGITAL



Quick Code: egmt5072

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Multiplying 4-Digit Numbers by 2-Digit Numbers. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Question

- How can models help mathematicians understand how and why algorithms work?

Lesson Learning Objective

- Students will correct misconceptions and errors related to using the standard algorithm to solve multi-digit multiplication problems.

Grade-Level Standard

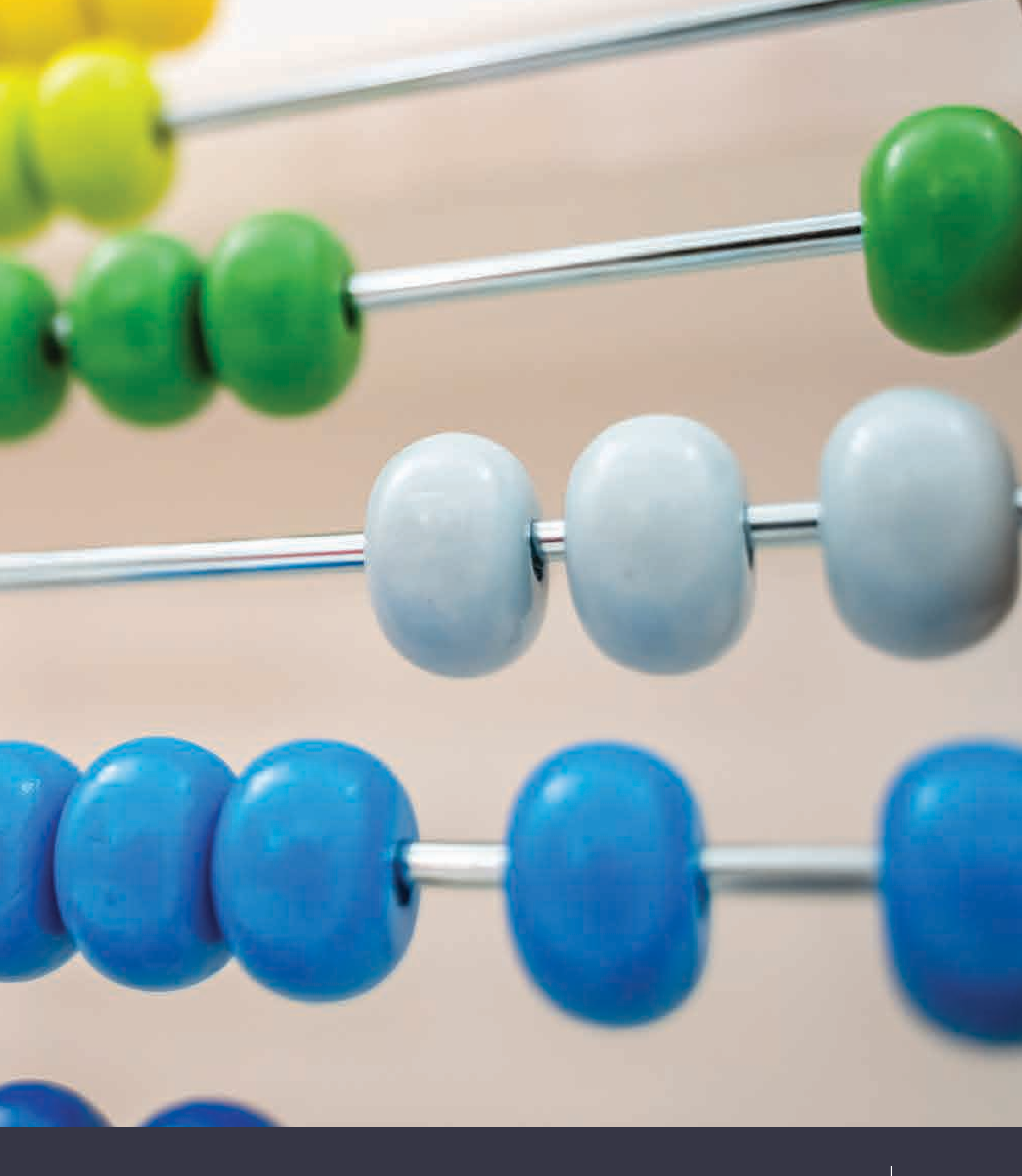
5.A.3.a Fluently multiply multi-digit whole numbers.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to see the relationship between the partial products model for multiplication and the standard algorithm.
- When using the standard algorithm to multiply multi-digit numbers, students sometimes ignore place value.
- Student may struggle when another digit is added to one of the factors.
- Students may struggle to understand what the story problem is asking them to do.
- Students may not be able to discern the steps necessary to solve a multistep story problem.

Remediation: Correcting Misconceptions

If . . .	Then . . .
Students struggle to see the relationship between the partial products model and the standard algorithm for solving multiplication problems.	Review Lesson 5 and provide students multiple opportunities to practice using the partial products model. Help students loop the products to see the connection to the standard algorithm. Use graph paper to help students organize their problems when using the standard algorithm.
If . . .	**Then . . .**
When using the standard algorithm for multi-digit numbers, the student ignores place value.	Work with a small group of students going through the steps of the algorithm. Use grid paper to help students to stay organized and neat. Also, allow students to master 2-digit by 2-digit multiplication before moving to 3- and 4-digit by 2-digit multiplication.
If . . .	**Then . . .**
Students struggle to understand what multistep story problems are asking.	Review the Three Reads Strategy. Have students read slowly and discuss their thinking after each read. Providing a graphic organizer may also help. Students can write notes and underline key information and numbers to keep track of the steps and the content.
If . . .	**Then . . .**
Students are not able to discern the steps necessary for a multistep story problem.	Review Lesson 7 and help students to break the problem apart into steps. Color code the numbers being used in each step to help students organize their thinking. Consider having students record each step as they go, such as: Step One: Step Two:



UNIT

4

DIVISION WITH WHOLE NUMBERS

Theme 2 | Mathematical Operations and Algebraic Thinking

ESSENTIAL QUESTIONS

- What does it mean to divide?
- What strategies can be used to divide?
- What strategies can be used to evaluate the reasonableness of answers?
- What does it mean to be a strategic problem solver?

Video Questions



Quick Code
egmt5073

The Unit 4 Opener Video, Mastering Division, explores math around Egypt through division. In this unit, students investigate the meaning of division and learn strategies for solving division problems. They explore its relationship to multiplication and utilize their problem-solving skills.

- How did the students use division to make sense of the world around them?
- What did the students find out about using patterns to solve division problems?



Key Vocabulary



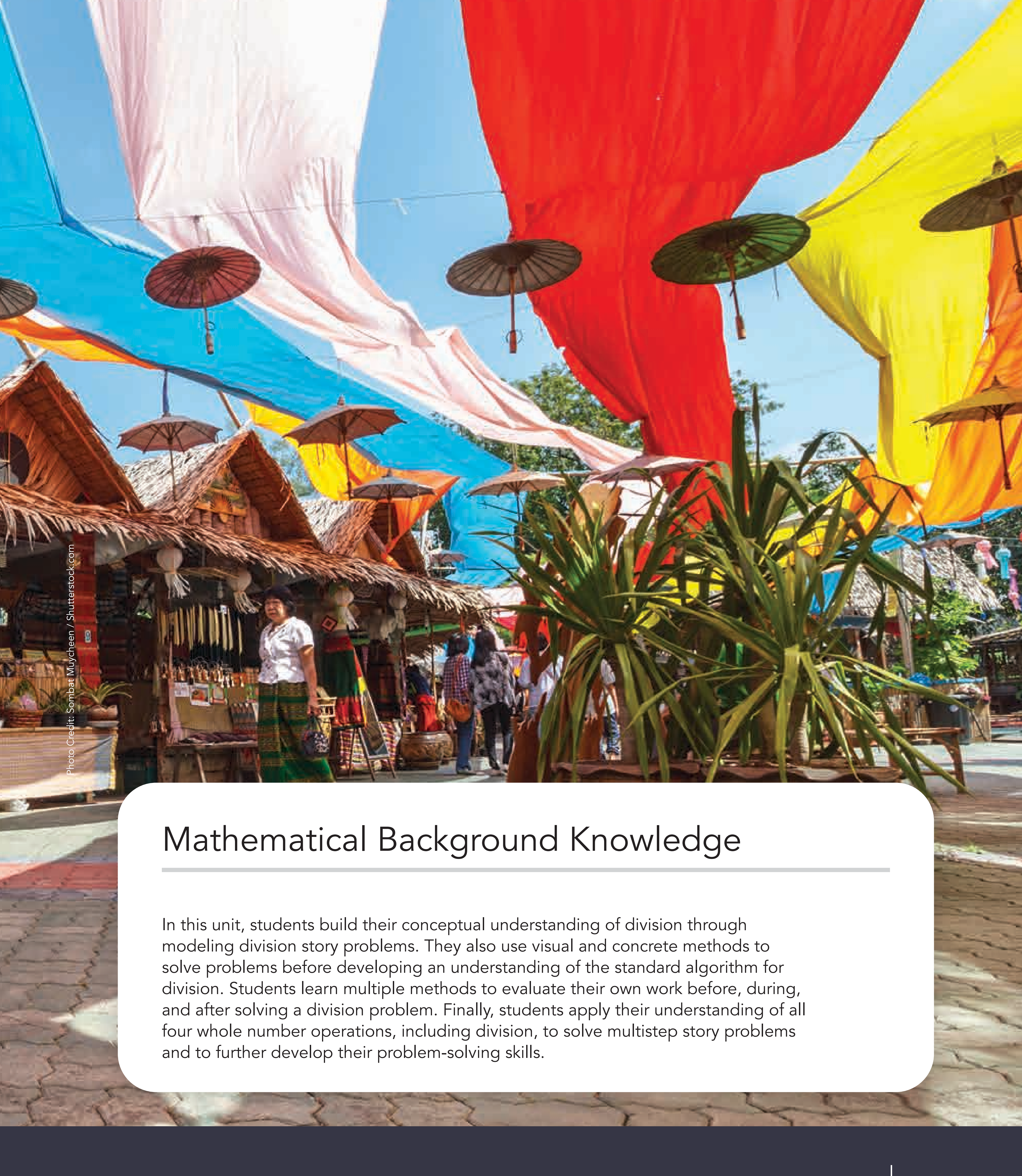
Quick Code
egmt5074

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

area model, compatible numbers, dividend, divisor, estimate, factor, inverse operations, multiple, multiplicative comparison, partial quotients model, product, quotient, remainder, round, unknown

Photo Credit: Sombat Muycheen / Shutterstock.com

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION


Photo Credit: Sombat Muycheen / Shutterstock.com

Mathematical Background Knowledge

In this unit, students build their conceptual understanding of division through modeling division story problems. They also use visual and concrete methods to solve problems before developing an understanding of the standard algorithm for division. Students learn multiple methods to evaluate their own work before, during, and after solving a division problem. Finally, students apply their understanding of all four whole number operations, including division, to solve multistep story problems and to further develop their problem-solving skills.



CONCEPT 1

Models for Division

Photo Credit: saragraphika / Shutterstock.com

Concept Overview

In Concept 1 Models for Division, students build meaning around division as an operation. Students then use area models and the partial quotients algorithm to develop their understanding of dividing by two-digit divisors. Finally, students utilize their number sense to estimate quotients in preparation for learning to use the standard algorithm for division.

Concept Standards

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

LESSON 1
Understanding Division

Lesson Overview

In this lesson, students strengthen their conceptual understanding of division and use division vocabulary to practice interpreting the meaning of division through story problems.

Lesson Essential Question

- What does it mean to divide?

Lesson Learning Objective

- Students will use story problems to explain the meaning of division problems.

Grade-Level Standards

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may interpret the divisor as always being the number of groups or as the amount in each group without considering the context of the problem.
- Students may struggle to understand that the word *times* in a comparison problem does not necessarily mean to multiply.




ACCESS (5 min)

Write and Solve

Ask students to choose three of the numbers from the list to create a division equation. Instruct students to show proof that their division equation is true by using words, drawings, diagrams, or numbers.

Answer Key for Write and Solve

Possible division equations (accept all variations):

- $100 \div 25 = 4$
- $100 \div 5 = 20$
- $35 \div 7 = 5$

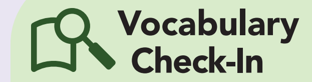
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Materials List

- Division Scenario Blackline Master



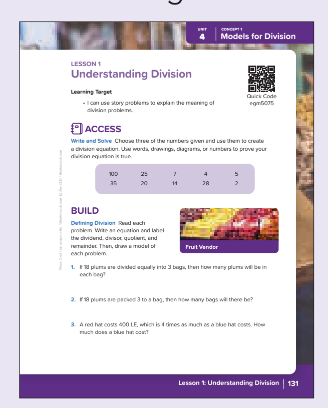
dividend, divisor, multiplicative comparison, quotient, remainder, unknown

VIDEO LESSON



Quick Code: egmt5076

Student Page 131



- 28 ÷ 7 = 4
- 28 ÷ 14 = 2
- 25 ÷ 5 = 5
- 20 ÷ 5 = 4
- 14 ÷ 7 = 2

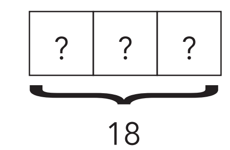
Explanations will vary.

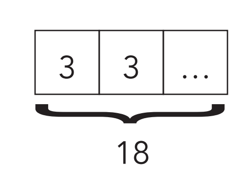
BUILD (45 min)  

Defining Division (20 min)

1. Write *division, dividend, divisor, quotient, and remainder* on the board. Read the words aloud one at a time, and invite students to share their definition of each word. After discussing, write the definitions on the board.
   - Division: the act of breaking into equal parts or groups
   - Dividend: the number being divided
   - Divisor: the number that is divided by
   - Quotient: the answer to a division problem
   - Remainder: the amount left over that is not enough to form another equal group
2. Ask students to visualize what is happening in Problems 1 and 2. Ask students if they are visualizing the same thing for both problems. In both problems, the total amount is being split equally. In Problem 1 they are trying to find out how many are in each group, but in Problem 2, they are trying to find out how many groups there are.
3. Ask students to explain why both problems are solved using division. Accept all reasonable answers and clarify misconceptions.
4. Ask students to help you write an equation for each problem, using a variable to represent the unknown quotient. Explain that the divisor is the same in each problem, but the divisor and quotient represent different things.
5. Ask volunteers to draw diagrams to show what is happening in each of the problems. Assist as needed. Examples shown.

Bar diagram





6. Ask students to discuss what is the same and different about Problems 3 and 4. Both problems compare the cost or size of one item to the other and are solved using division. However, in one problem they know how many times more the item is than the other, but in the other problem they are trying to figure out how many times more.

7. Ask students to share what they remember from Primary 4 about multiplicative comparisons. Correct any misconceptions.

8. Write an equation using a variable to represent the unknown in each problem. Explain that even though the dividend is the same in each problem, the divisor and quotient represent different things.

9. Draw a diagram to model what is happening in each of the problems.

400			
?	?	?	?

100	100	100	100
400			

10. Explain that there are two common types of division story problems—equal group problems and comparison problems. Even though both are solved using division, what the divisor and the quotient represent can vary.

Answer Key for Defining Division

1. 18 (dividend) ÷ 3 (divisor) = 6 plums (quotient); Models will vary.

2. 18 (dividend) ÷ 3 (divisor) = 6 bags (quotient); Models will vary.

3. 400 (dividend) ÷ 4 (divisor) = 100 LE (quotient)

4. 400 (dividend) ÷ 100 (divisor) = 4 times greater (quotient)

Representing Division (25 min)

1. Divide students into pairs. Distribute the Division Scenarios Blackline Masters to pairs so that one student receives the Partner A set and the other student receives the Partner B set.

2. Go over the directions with students, and give them time to play the game. As students play, walk around and offer assistance as needed.

3. Ask students to share their answers. If time allows, ask students to discuss how they knew which problems were represented by Number in Each Group or Number of Groups.

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Answer Key for Representing Division

Set A

1. $72 \div 4 = ?$; Number of Groups
2. $56 \div 7 = ?$; Number in Each Group
3. $305 \div 5 = ?$; Number of Groups
4. $42 \div 6 = ?$; Number in Each Group
5. $842 \div 45 = ?$; Number in Each Group
6. $50 \div 24 = ?$; Number of Groups

Set B

1. $60 \div 6 = ?$; Number of Groups
2. $56 \div 7 = ?$; Number of Groups
3. $305 \div 5 = ?$; Number in Each Group
4. $74 \div 3 = ?$; Number of Groups
5. $842 \div 45 = ?$; Number of Groups
6. $502 \div 60 = ?$; Number in Each Group



CONNECT (7 min)



Writing About Math

Read the story problem aloud and ask students to complete the learning activity.

Answer Key for Writing About Math

Model A is correct. The divisor represents the number of groups.

WRAP-UP (3 min)





Let's Chat About Our Learning

Ask students to share their answers and explanations from CONNECT.



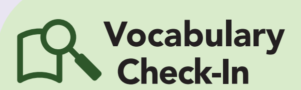
PRACTICE

1. Dividend: 215
   Divisor: 5
   Quotient: 43
2. Dividend: 1,514
   Divisor: 36
   Quotient: 170 R2
   Remainder: 2
3. $5{,}328 \div 7 = ?$
   Number of groups
4. $312 \div 24 = ?$
   Number in each group
5. 34

DIGITAL



Quick Code:
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Vocabulary Check-In

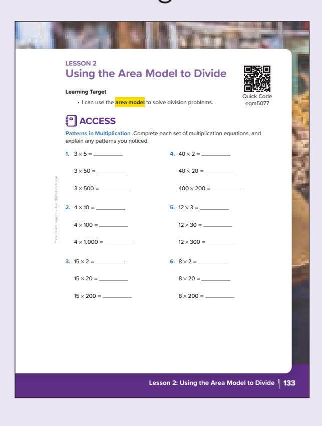
area model, dividend, divisor, multiple, quotient, remainder

VIDEO LESSON



Quick Code:
egmt5078

Student Page 133



LESSON 2
Using the Area Model to Divide

Quick Code
egm5077

Learning Target

- I can use the **area model** to solve division problems.

ACCESS

Patterns in Multiplication Complete each set of multiplication equations, and explain any patterns you noticed.

1. $3 \times 5 =$ ____
   $3 \times 50 =$ ____
   $3 \times 500 =$ ____
2. $4 \times 10 =$ ____
   $4 \times 100 =$ ____
   $4 \times 1{,}000 =$ ____
3. $15 \times 2 =$ ____
   $15 \times 20 =$ ____
   $15 \times 200 =$ ____
4. $40 \times 2 =$ ____
   $40 \times 20 =$ ____
   $400 \times 200 =$ ____
5. $12 \times 3 =$ ____
   $12 \times 30 =$ ____
   $12 \times 300 =$ ____
6. $8 \times 2 =$ ____
   $8 \times 20 =$ ____
   $8 \times 200 =$ ____

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Lesson 2: Using the Area Model to Divide | 133

LESSON 2
Using the Area Model to Divide

Lesson Overview

In this lesson, students use the area model to divide dividends with up to four digits by divisors with up to two digits.

Lesson Essential Question

- What strategies can be used to divide?

Lesson Learning Objective

- Students will use the area model to solve division problems.

Grade-Level Standard

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

COMMON MISCONCEPTIONS AND ERRORS

Students may have difficulty identifying multiples and recognizing patterns between multiples as place value increases.



ACCESS (5 min)



Patterns in Multiplication

Ask students to complete each set of multiplication equations. Then, ask students to explain any patterns that they noticed.

Answer Key for Patterns in Multiplication

1. $3 \times 5 = 15$
   $3 \times 50 = 150$
   $3 \times 500 = 1{,}500$
2. $4 \times 10 = 40$
   $4 \times 100 = 400$
   $4 \times 1{,}000 = 4{,}000$
3. $15 \times 2 = 30$
   $15 \times 20 = 300$
   $15 \times 200 = 3{,}000$

4. $40 \times 2 = 80$
$40 \times 20 = 800$
$400 \times 200 = 80,000$

5. $12 \times 3 = 36$
$12 \times 30 = 360$
$12 \times 300 = 3,600$

6. $8 \times 2 = 16$
$8 \times 20 = 160$
$8 \times 200 = 1,600$

Possible explanation: When there are zeroes on the end of a factor, you can multiply using the basic multiplication facts that you know and adjust the product depending on how many zeroes it should have.

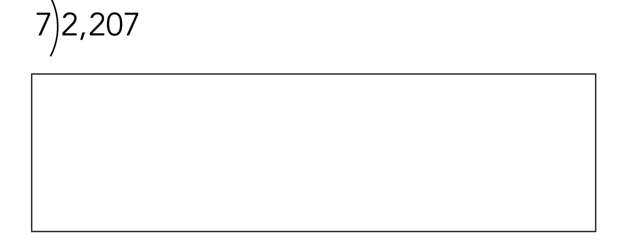
Student Page 134

BUILD (45 min) 

Whiteboard: Using the Area Model (20 min)

1. Remind students that they practiced solving division problems with a 1-digit divisor using an area model in Primary 4 and that there are many ways to break apart the dividend when using an area model.
2. Write $2,707 \div 7$ on the board and draw a rectangular box underneath.

$7\overline{)2,207}$



3. Since 7 is the divisor, write 7 along the left side of the box. Remind students that they can think of this problem as finding how many groups of 7 are in 2,207. Ask students to use the multiplication patterns from ACCESS to get close to 2,207. Write $7 \times 3 = 21$, $7 \times 30 = 210$, and $7 \times 300 = 2,100$ on the board.

$7\overline{)2,207}$

7

4. Since 300 groups of 7 is closest to the dividend, write 300 above the box. Inside the box, write $2{,}207 - 2{,}100 = 107$. Draw a vertical line to the right of this problem inside the box.

$7\overline{)2{,}207}$

	300	
7	2,207 – 2,100 107	

5. The part of the dividend that still needs to be divided is 107. Explain that you will use a multiple of 10 since that is a friendly number. Write 10 above the box. Inside the box, write the equation $107 - 70 = 37$ vertically and draw a vertical line to the right.

$7\overline{)2{,}207}$

	300	10	
7	2,207 – 2,100 107	107 – 70 37	

6. The amount that still needs to be divided is 37. Ask students to recall their multiplication facts to determine what number multiplied by 7 gets them close to 37. $7 \times 5 = 35$

7. Write 5 above the third column and then write $37 - 35 = 2$ inside the box below it.

$7\overline{)2{,}207}$

	300	10	5
7	2,207 – 2,100 107	107 – 70 37	37 – 35 2

8. Ask students if there is enough left for another equal group of seven. Since there is not enough for another group, there is a remainder.

9. Model adding each of the numbers above the rectangle in order to find the quotient. Remind students to include the remainder in the final answer.

$$7\overline{)2{,}207} = 315 \text{ R2}$$

	300 +	10 +	5 = 315
7	2,207 – 2,100 107	107 – 70 37	37 – 35 2

10. Tell students that they will solve problems with two-digit divisors in Primary 5. Repeat the process with 1,625 ÷ 13. Remind students to use the multiplication patterns from ACCESS. Example shown.

$$13\overline{)1{,}625} = 125$$

	100 +	20 +	5 = 125
13	1,625 – 1,300 325	325 – 260 65	65 – 65 0

11. Allow students time to copy both models into their Student Materials.

Answer Key for Using the Area Model

1. 315 R2
2. 125

Model Match (25 min)

Go over the directions with students, and then ask them to complete the learning activity independently or with a partner. Ask students to share their answers and explain how they knew what numbers to add to the area model for each problem.

Answer Key for Model Match

1. C; 114
2. A; 116 R26
3. B; 150
4. E; 61
5. D; 103 R26

A. 31

100	10	6
3,622 – 3,100 522	522 – 310 212	212 – 186 26

100 + 10 + 6 = 116 R26

B. 7

100	50
1,050 – 700 350	350 – 350 0

100 + 50 = 150

C. 81

100	10	2	2
9,234 – 8,100 1,134	1,134 – 810 324	324 – 162 162	162 – 162 0

100 + 10 + 2 + 2 = 114

D. 52

100	2	1
5,382 – 5,200 180	7 1 182 – 104 78	78 – 52 26

100 + 2 + 1 = 103 R26

E. 43

50	10	1
2,623 – 2,150 473	473 – 430 43	43 – 43 0

50 + 10 + 1 = 61

CONNECT (7 min)

Writing About Math: Error Analysis

Remind students that there is more than one way to use an area model to correctly solve a division problem. Ask students to analyze the example of a student's area model and identify what the student did incorrectly.

24) 2,852

	10	5	100	3
24	2,852 − 240 = 2,612	2,612 − 120 = 2,492	2,492 − 2,400 = 92	92 − 72 = (20)

2,852 ÷ 24 = 20

Answer Key for Writing About Math: Error Analysis

Possible answers include: The student forgot to add the numbers above the box to get the quotient. The student wrote down that the remainder is the quotient. The student did not start with the largest amount. While this is not necessarily a mistake, an area model is more efficient when it starts with larger amounts.

WRAP-UP (3 min)



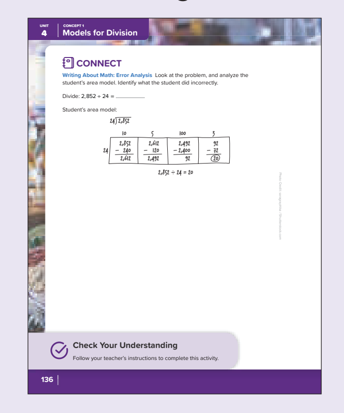
Let's Chat About Our Learning

Ask students to share their answers and ideas from CONNECT.

PRACTICE

1. 2,284 ÷ 4 = 571
2. 3,515 ÷ 7 = 502 R1
3. 368 ÷ 16 = 23
4. 231 ÷ 33 = 7
5. 6,867 ÷ 52 = 132 R3

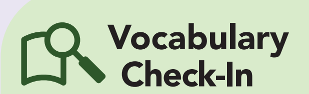
Student Page 136



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Vocabulary Check-In

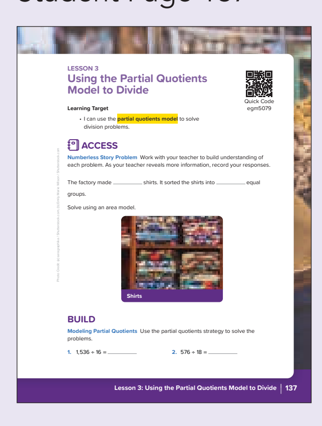
area model, dividend, divisor, multiple

VIDEO LESSON



Quick Code:
egmt5080

Student Page 137


LESSON 3
Using the Partial Quotients Model to Divide

ACCESS

BUILD

Lesson 3: Using the Partial Quotients Model to Divide | 137

LESSON 3
Using the Partial Quotients Model to Divide

Lesson Overview

In this lesson, students divide dividends with up to four digits by divisors with up to two digits using the partial quotients algorithm.

Lesson Essential Question

- What strategies can be used to divide?

Lesson Learning Objective

- Students will use the partial quotients model to solve division problems.

Grade-Level Standard

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

COMMON MISCONCEPTIONS AND ERRORS

Students may have difficulty identifying multiples and recognizing patterns between multiples as place value increases.



ACCESS (10 min)

Numberless Story Problem

1. Read the problem aloud and tell students they will fill in the blanks with the information they are given.
2. Ask students to discuss what they are picturing in their minds when they read this problem. Ask questions as needed to prompt thinking, such as



- *What do we know so far?*
- *How many shirts could the factory have made?*
- *What does it mean to sort the shirts into equal groups?*

3. Tell students that the factory made 576 shirts. Direct students to record the number. Ask:



- *What changed?*
- *What do we know now that we did not know before?*
- *What does this tell us about the shirts sorted into the equal groups?*



4. Tell students that the factory sorted the shirts into 18 equal groups. Direct students to record the number. Ask:



- *What new information do we have?*
- *What questions could be asked using this information?*

5. Ask students to write the question in the final blank: *How many shirts were in each group?* Ask:



- *What is the question asking?*
- *Do we have all the information we need to answer the question?*

6. Ask students to solve the problem using an area model.

Answer Key for Numberless Story Problem

32 shirts

BUILD (40 min) 

Modeling Partial Quotients (15 min)

1. Write $1{,}536 \div 16 =$ _____ on the board. Explain to students that they could use an area model to solve this problem, but they will practice using the partial quotients model today.

2. Draw a beginning model as shown.

```
16)1,536
 – ____ |_____
```

3. Remind students that thinking about multiples can help them start using this strategy. Write on the board: $16 \times 10 = 160$ and $16 \times 100 = 1{,}600$. Because 1,600 is greater than the dividend, a useful way to begin is to take half of that number. Half of 100 is 50. Write $16 \times 50 = 800$.

4. Write 50 to the right of the vertical line. Write 800 below the dividend. Subtract and write the difference: 736. Draw the next line of the model with blanks.

```
16)1,536
 –  800 | 50
    736
 – ____ |_____
```

5. Ask students to look at what is remaining of the dividend. If necessary, explain that we know that $16 \times 50 = 800$, and 800 is larger than the amount that still needs to be divided. A useful way to continue is to take half of that. Half of 50 is 25. Write $16 \times 25 = 400$.

Numberless Story Problem
Teacher Note for #1:

The purpose of a numberless story problem is to build students' ability to visualize and make sense of the problem before rushing to solve the problem. This supports their developing ability to make sense of the situation, apply the appropriate operation to solve, and judge the reasonableness of their response. In this strategy, the problem is presented initially without any numbers. After students answer prompts about their thinking, additional information is added. This process continues until the entire problem is revealed, and then students are asked to solve the problem.

6. Write 25 to the right of the line. Write 400 below the dividend. Subtract and write the difference: 336. Draw another line of blanks for the next partial quotient.

```
16)1,536
 − 800 | 50
   736
 − 400 | 25
   336
 − ___ | ___
```

7. Tell students that 336 is the amount that remains to be divided. Remind students that another useful strategy is to use multiples of 10. Since $16 \times 10 = 160$, then $16 \times 20 = 320$. Write 20 to the right and subtract 320 from 336 for a difference of 16. Draw a final line of blanks for the remaining partial quotient.

```
16)1,536
 − 800 | 50
   736
 − 400 | 25
   336
 − 320 | 20
    16
 − ___ | ___
```

8. There is 16 left to be divided. Because 16 is the divisor, and $16 \times 1 = 16$, write 1 in the blank to the right. Subtract and write the difference: $16 - 16 = 0$. There is nothing left to be divided and there is no remainder.

```
16)1,536
 − 800 | 50
   736
 − 400 | 25
   336
 − 320 | 20
    16
 −  16 |  1
     0
```

9. Explain to students that all the numbers to the right are parts of the quotient. Add them together to determine the quotient.

```
        96
16)1,536
  −  800 | 50
     736
  −  400 | 25
     336
  −  320 | 20
      16
  −   16 | 1      50 + 25 + 20 + 1 = 96
       0
```

10. Allow students time to copy the example into their Student Materials. Direct students to work independently or with a partner to solve Problem 2 using the partial quotients model.

Answer Key for Modeling Partial Quotients

1. $1{,}536 \div 16 = 96$
2. $576 \div 18 = 32$

Fill in the Blank (25 min)

Go over the directions with students and give them time to complete the learning activity. As students work, walk around and offer assistance as needed.

Answer Key for Fill in the Blank

1.
```
      118 R13
23)2,727
 − 2,300 | 100
     427
 −   230 | 10
     197
 −    69 | 3
     128
 −    69 | 3
      59
 −    46 | 2
      13
```

2.
```
      134 R3
60)8,063
 − 6,000 | 100
   2,063
 − 1,800 | 30
     263
 −   240 | 4
      23
```

3.
```
      817
3)2,451
 − 2,400 | 800
      51
 −    30 | 10
      21
 −    21 | 7
       0
```

Fill in the Blank
Teacher Note:

This activity can be done individually, in pairs, or in small groups. If students work independently, they should check their work with a partner when finished. This is a good time for you to work with a small group of students who may need additional instruction and support.

4.

512

9)4,608
− 4,500 | 500
108
− 90 | 10
18
− 18 | 2
0

5.

412

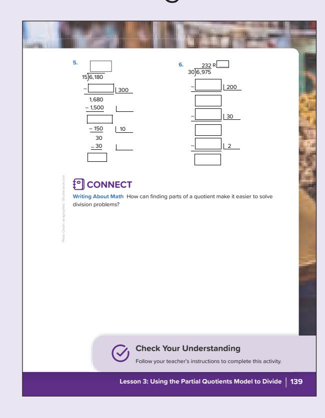
15)6,180
− 4,500 | 300
1,680
− 1,500 | 100
180
− 150 | 10
30
− 30 | 2
0

6.

232 R 15

30)6,975
− 6,000 | 200
975
− 900 | 30
75
− 60 | 2
15

Student Page 139



CONNECT (7 min) 

Writing About Math

Ask students to respond to the question.

Answer Key for Writing About Math

Possible answers include: It allows me to use numbers I am more familiar with; it breaks the problem down into smaller chunks.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their thinking from CONNECT. Encourage students to ask each other questions. Clear up lingering misconceptions.

PRACTICE

1. 650 ÷ 25 = 26
2. 1,288 ÷ 23 = 56
3. 6,572 ÷ 54 = 121 R38
4. 6,810 ÷ 40 = 170 R10
5. 5,796 ÷ 92 = 63



LESSON 4
Estimating Quotients

Lesson Overview
In this lesson, students round divisors and adjust dividends to estimate and check the reasonableness of their quotients.

Lesson Essential Questions
- What does it mean to divide?
- What strategies can be used to divide?
- What strategies can be used to evaluate the reasonableness of answers?

Lesson Learning Objective
- Students will use estimation to check the reasonableness of their answers.

Grade-Level Standard
5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

COMMON MISCONCEPTIONS AND ERRORS
- Students may round the dividend to the greatest place instead of rounding it to a compatible number. This may result in a number that is not easily divisible by the divisor.
- Students may struggle to determine whether their answer is reasonable if their estimate is not close to the actual answer.


ACCESS (10 min)


Mental Math
1. Give students a couple minutes to solve the division problems mentally.
2. Discuss what makes these problems easy to solve mentally. Explain that these problems contain compatible numbers. Compatible numbers are numbers that are easy to add, subtract, multiply, or divide mentally.
3. Ask students what other types of numbers or number relationships they know that could be compatible numbers. Doubles, pairs of numbers that make 10, multiplication and division fact families, and powers of 10 are compatible numbers.

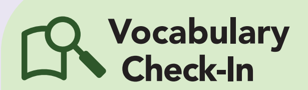
DIGITAL



Quick Code: egmt5081

Materials List
- Winner Takes All Cards Blackline Master

Preparation
- Photocopy and cut out Winner Takes All cards at the end of this volume, and give one set to each student.

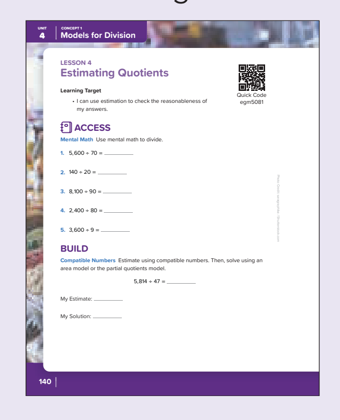

Vocabulary Check-In
compatible numbers, dividend, divisor, estimate, quotient, remainder, round

VIDEO LESSON



Quick Code: egmt5082

Student Page 140



4. Explain to students that they will use compatible numbers to help estimate quotients in today's lesson.

Answer Key for Mental Math

1. $5{,}600 \div 70 = 80$
2. $140 \div 20 = 7$
3. $8{,}100 \div 90 = 90$
4. $2{,}400 \div 80 = 30$
5. $3{,}600 \div 9 = 400$

BUILD (40 min) 

Compatible Numbers (20 min)

1. Ask students to follow along as you model how to estimate quotients using compatible numbers. Write $3{,}156 \div 62 =$ _____ on the board. Round 62 to 60. Do a Think Aloud: *What multiple of 6 is close to 31 (the first 2 digits of the dividend)?* 6, 12, 18, 24, 30. *The number that is compatible with 6 and is closest to 31 is 30, so if I think of 3,156 as 3,000, I can divide mentally.*
2. Write on the board: $3{,}000 \div 60 = 50$. Then, solve $3{,}156 \div 62 =$ _____ using an area model or the partial quotients model. Ask students to compare the estimate to the answer. The quotient is 50, but there is a remainder of 56.
3. Write $1{,}428 \div 14$ on the board. Do a Think Aloud, rounding 1,428 to 1,000 and 14 to 10.
4. Ask students if there was another way to round 1,428 and 14 to solve mentally. Example: $1{,}400 \div 14$
5. Solve the equation using an area model of the partial quotients model. Ask students to compare the estimate to the answer. Ask students if 102 is a reasonable answer. Yes, although it is greater than the estimate, 102 is close to 100 so it is reasonable.
6. Direct students to work with a partner to solve the problem in their Student Materials. Ask volunteers to share their work on the board and explain their thinking. Ask students to discuss how estimating with compatible numbers helps them solve problems. Estimating with compatible numbers before solving a division problem helps us get started and gives an idea what the answer will be. Estimating helps us determine whether our answer is reasonable.

Answer Key for Compatible Numbers

$6{,}000 \div 50 = 120$ or $5{,}000 \div 50 = 100$; $5{,}814 \div 47 = 123$ R33

Winner Takes All (20 min)

1. Distribute a set of Winner Takes All cards to each student. Assign each student a partner. Read the directions with students. Remind students that they should estimate using compatible numbers.

2. At the end of BUILD, ask students to reflect on estimating quotients:



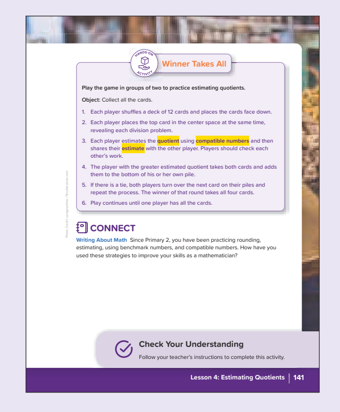
- *When might you estimate outside of math class? When an exact answer is not needed.*
- *In which situations are the actual answer and the estimate fairly close together? When both the actual numbers are close to the rounded numbers or when both numbers are rounded in the same direction.*
- *In which situations are the estimates and actual answers further apart? When one number is rounded up and the other is rounded down.*



CONNECT (7 min)



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Writing About Math

Read the prompt to students and give them time to respond.

Answer Key for Writing About Math

Answers will vary, but students may recognize that rounding, estimating, and using compatible and benchmark numbers help them use mental math and check the reasonableness of their answers.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT question. Encourage students to ask each other questions. Clear up lingering misconceptions.

PRACTICE

Possible estimates shown.

1. $3{,}000 \div 20 = 150$ or $2{,}000 \div 20 = 100$; $2{,}992 \div 22 = 136$
2. $4{,}500 \div 50 = 90$ or $4{,}000 \div 40 = 100$; $4{,}607 \div 45 = 102$ R17
3. $2{,}400 \div 60 = 40$; $2{,}452 \div 61 = 40$ R12
4. $2{,}000 \div 50 = 40$; $1{,}967 \div 54 = 36$ R23
5. $9{,}000 \div 30 = 300$; $8{,}985 \div 33 = 272$ R9

DIGITAL



Quick Code:
egmt5083

CONCEPT CHECK-IN AND REMEDIATION
Models for Division

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Models for Division. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What does it mean to divide?
- What strategies can be used to divide?
- What strategies can be used to evaluate the reasonableness of answers?

Lesson Learning Objective

- Students will correct misconceptions and errors related to modeling division problems.

Grade-Level Standards

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may interpret the divisor as always being the number of groups or as the amount in each group without considering the context of the problem.
- Students may struggle to understand that the word *times* in a comparison problem does not necessarily mean to multiply.
- Students may have difficulty identifying multiples and recognizing patterns between multiples as place value increases.
- Students may round the dividend to the greatest place instead of rounding it to a compatible number. This may result in a number that is not easily divisible by the divisor.
- Students may struggle to determine whether their answer is reasonable if their estimate is not close to the actual answer.

Remediation: Correcting Misconceptions

If . . .	Then . . .
Students struggle to determine the meaning of the divisor in a story problem.	Review Lesson 1 BUILD. Encourage students to draw models of story problems or ask students to create stories that could go with a division equation.
If . . . Students have difficulty identifying multiples and recognizing patterns between multiples as place value increases.	**Then . . .** Review Lesson 2 ACCESS. Provide additional problems where the value of the factors increases by a power of 10.
If . . . Students have trouble efficiently working up to the dividend using multiples of the divisor.	**Then . . .** Review Lesson 2 BUILD and Lesson 3 BUILD. Provide additional problems and encourage students to get as close as they can to the amount that needs to be divided each time. Consider working with manipulatives. Have students subtract multiples of 10 from the dividend and record their results until they find the quotient.

CONCEPT 2

Dividing by 2-Digit Divisors

Concept Overview

In Concept 2 Dividing by 2-Digit Divisors, students apply their conceptual understanding of division to solve division problems with two-digit divisors using the standard algorithm. Although the standard algorithm is an abstract method for dividing, it is the most efficient strategy. Students utilize the relationship between multiplication and division to check for the reasonableness of their answers. Now that students have worked toward mastery of all four operations with whole numbers, students apply their problem-solving skills to solve multistep story problems involving division.

Concept Standards

5.A.3 Perform operations with multi-digit whole numbers and with decimals to hundredths.

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

5.B.2.b Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

LESSON 5
Using the Standard Algorithm to Divide

Lesson Overview

In this lesson, students are introduced to the standard algorithm for division with two-digit divisors.

Lesson Essential Questions

- What strategies can be used to divide?
- What strategies can be used to evaluate the reasonableness of answers?

Lesson Learning Objective

- Students will use the standard algorithm to divide by a two-digit divisor.

Grade-Level Standard

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

COMMON MISCONCEPTIONS AND ERRORS

- Students may forget the importance of place value in division, particularly when recording the quotient.
- Students may underestimate while solving the problem. This may result in a quantity that is greater than the divisor.
- When using the standard algorithm, students may believe they are finished solving a problem and forget to bring down the next digit in the dividend.
- Errors can occur when place value columns are not maintained throughout a problem. Consider providing students with graph paper or turning lined paper sideways.

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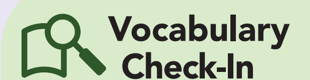
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Materials List

- Small container to hold beans
- Dried beans, any kind
- Small scoop
- Sticky notes
- Graph paper or lined paper (optional)

Preparation

- Set up the materials for the Dividing Beans activity.



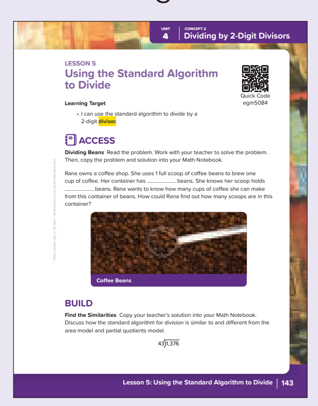
dividend, divisor, estimate, quotient, remainder, round

VIDEO LESSON



Quick Code: egmt5085

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Dividing Beans
Teacher Note For #1:

This is a hands-on problem that requires preparation before the lesson. If materials are not available, go directly to Step 3. The same problem introduced in ACCESS will be expanded on in the BUILD portion of this lesson.

Find the Similarities
Teacher Note for #1:

If you used your own numbers for the ACCESS problem, continue using your numbers. If you used the numbers provided, continue using those numbers. The step-by-step directions below use the numbers provided.

ACCESS (10 min) 

Dividing Beans

1. Before class begins, count the number of beans your scoop holds and the number of scoops it takes to fill your container. Use the same number of beans in each scoop as you fill the container. The number of beans will become the divisor, and the number of scoops will become the quotient that the class will find. Multiply the number of beans per scoop and the number of scoops it took to fill the container to find the total number of beans in the container. This will become the dividend. The total will be an estimate, which is fine. Label the container with the total.
2. Fill the scoop with beans, and show the class the full container and the full scoop. Ask a student to count the number of beans in the scoop. Ask the class to estimate the total number of scoops that it took to fill the container. Accept all estimates. Ask students to discuss why they think their estimates are reasonable.
3. Ask students to read the problem. Help students to fill in the blanks with the numbers from the hands-on demonstration, or tell students that a scoop holds 43 coffee beans and that the container holds 1,376 coffee beans.
4. Circulate around the class as students discuss problem-solving strategies and encourage them to think creatively. Students should not solve the problem at this time.
5. Discuss possible strategies with the class. Select two to three students to share their thinking. Highlight responses that relate to the standard algorithm of division.

BUILD (40 min) 

Find the Similarities (15 min)

1. Ask students to share what they remember about the standard algorithm for division. Clear up any misconceptions. Remind students that the standard algorithm is the most efficient strategy. They learned about the area model and the partial quotients model to help them prepare to learn the standard algorithm.
2. Write the division problem on the board as shown. Model how to solve the division problem using the standard algorithm. Do Think Alouds to help students understand the role of estimation and place value.

   $43\overline{)1,376}$
3. Ask students to compare the standard algorithm with other division strategies. Accept all reasonable answers.
4. Direct students to copy the standard algorithm example into their Math Notebook.

Answer Key for Find the Similarities

Rana can brew 32 cups of coffee. Setting up the problem is similar when using the partial quotients model. Subtraction is used in all strategies. Only the first two or three digits were considered when using the standard algorithm, not the whole number.

Let's Try It (25 min)

1. Write Problem 1 on the board. Ask students to copy the solution in their Student Materials as you model the standard algorithm for division. Ask students to help you as you work.
2. Repeat the process with Problem 2.
3. Clear up any lingering questions and misconceptions. Depending on students' progress, have them work independently or with a partner to solve Problems 3 and 4. Consider pulling a small group of students to work directly with you.

Answer Key for Let's Try It

1. $192 \div 32 = 6$
2. $543 \div 65 = 8$ R23
3. $756 \div 22 = 34$ R8
4. $8,014 \div 46 = 174$ R10




CONNECT (7 min)

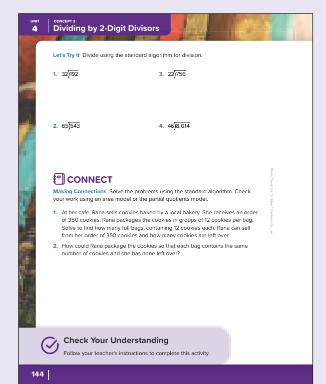
Making Connections

Ask students to use the standard algorithm to solve the problems and to check their work using an area model or the partial quotients model.

Answer Key for Making Connections

1. 29 R2 (Rana can sell 29 bags of cookies, and she will have 2 cookies left over.)
2. Answers will vary. Possible answers: Packages of 2, 5, 7, 10, 14, 25, 35, 50, 70, or 175

Student Page 144



WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to reflect on the different division strategies they have learned for dividing by two-digit numbers. Ask students which strategy is easiest for them to use and which strategy they would like to continue to practice.

PRACTICE

1. 547 ÷ 25 = 21 R22
2. 5,009 ÷ 18 = 278 R5
3. 9,567 ÷ 81 = 118 R9
4. 6,203 ÷ 11 = 563 R10
5. 1,974 ÷ 48 = 41 R6

LESSON 6
Checking Division with Multiplication

Lesson Overview
In this lesson, students continue using the standard algorithm for division to divide by two-digit divisors. They also use multiplication to check the accuracy of their division work.

Lesson Essential Question
- What strategies can be used to evaluate the reasonableness of answers?

Lesson Learning Objectives
- Students will use the standard algorithm to divide by a two-digit divisor.
- Students will use multiplication to check answers to division problems.

Grade-Level Standard
5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to understand when 0 is needed in the quotient. They may believe that they are finished with the problem when they cannot divide the new dividend by the divisor.
- Students may have difficulty performing the correct operations in the proper order when using the quotient, divisor, and remainder to check an answer to a division problem.
- Students may struggle to maintain place value columns throughout a problem. Consider providing students with graph paper.





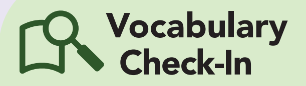
Error Analysis
Ask students to review Ayman's solution and work with a partner to conduct an error analysis. Call on volunteers to explain their thinking. If time allows, work with students to find the correct quotient using the standard algorithm.

DIGITAL



Quick Code: egmt5086

Materials List
- Keep the Leftovers Recording Sheet
- Graph paper (optional)



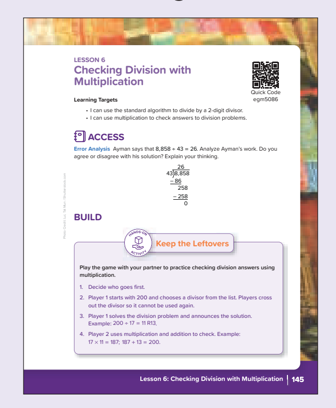
dividend, divisor, factor, inverse operations, product, quotient, remainder

VIDEO LESSON



Quick Code: egmt5087

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LESSON 6
Checking Division with Multiplication
ACCESS
BUILD
Keep the Leftovers
Lesson 6: Checking Division with Multiplication | 145

Answer Key for Error Analysis

Disagree. Ayman brought down two digits after he subtracted the first time, rather than just bringing down the 5. Students may also note that the estimated quotient is around 200 or that 43×26 does not equal the dividend.

BUILD (40 min) 

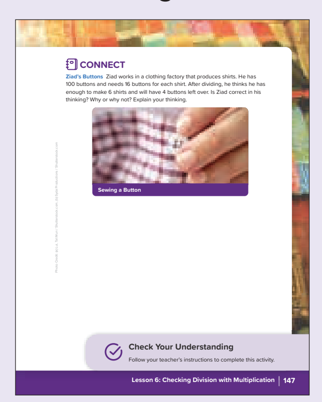
Keep the Leftovers

1. Remind students that multiplication and division are inverse operations, so one way they could tell that Ayman's solution was incorrect was by multiplying the quotient by the divisor to see if they get the dividend.
2. Write $300 \div 16$ on the board in the standard algorithm format. Ask students to help you solve the problem using the standard algorithm. Then, model on the board how to check the answer using multiplication. If necessary, model additional examples.
3. Introduce the game, and go over the directions. Assign partners, and give students time to play the game. As they play, walk around and monitor students' progress and conversations. Offer help as needed.
4. If partners finish early, have them play again. Suggest that the other player goes first, they start with 199 as the dividend, or they use 15 to 25 as divisors.

Whiteboard: Keep the Leftovers Recording Sheet

Ask students to record their results from the Keep the Leftovers game in their Student Materials, or using a Whiteboard and then uploading their responses.

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CONNECT (3 min) 

Ziad's Buttons

Ask students to read the problem and respond to the questions.

Answer Key for Ziad's Buttons

Ziad is correct. Explanations will vary but should show $16 \times 6 = 96$; $96 + 4 = 100$.

WRAP-UP (7 min)



Let's Chat About Our Learning

Ask students to discuss the strategies they used when they played the Keep the Leftovers game. Ask questions as needed to prompt students' thinking:

ASK

- *Which strategies did you use to decide which numbers were best to use? Possible responses: Large divisors can leave larger remainders. Numbers that do not share factors with the dividend will leave a remainder.*
- *What is the best number to use for a first move? Why? Possible responses: 20 will not leave a remainder because it is a factor of 200. Since $19 \times 10 = 190$, the remainder is 10. Because $18 \times 11 = 198$, the remainder is 2, but $17 \times 11 = 187$, so the remainder is 13. 13 is the greatest remainder for the first move.*
- *What is the sum of your last starting number, your points, and your partner's points? Possible responses: When they add these numbers, nothing is gained or lost. The numbers were divided and regrouped. Students start with 200 so there are still 200 at the end.*

PRACTICE

1. $2{,}443 \div 8 = 305$ R3
2. $8{,}453 \div 14 = 603$ R11
3. Incorrect; 20 R2
4. Correct
5. Incorrect; 26

Challenge Incorrect; 24 R12

DIGITAL



Quick Code: egmt5088

Materials List

- Thinking Like a Mathematician Anchor Chart
- Poster paper (optional)

VIDEO LESSON



Quick Code: egmt5089

LESSON 7
Multistep Story Problems

Lesson Overview

In this lesson, students work to develop and strengthen their problem-solving skills to better understand how to solve multistep story problems involving addition, subtraction, multiplication, and division of whole numbers.

Lesson Essential Questions

- What does it mean to divide?
- What strategies can be used to evaluate the reasonableness of answers?
- What does it mean to be a strategic problem solver?

Lesson Learning Objective

- Students will solve multistep story problems involving whole numbers and the four operations.

Grade-Level Standards

5.A.3 Perform operations with multi-digit whole numbers and with decimals to Hundredths.

5.B.2.b Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may solve the first part of a multistep problem but not subsequent parts if they do not thoroughly interpret the problem before attempting to solve.
- Students who rely on key words may misinterpret what is happening in the problem. For example, students may think that "in all" always means to add in a problem though it means multiplication. Example: *Avocados come 4 to a bag. Tamer buys 3 bags. How many avocados does he have in all?*

 ACCESS (10 min) 

Making Sense of Remainders

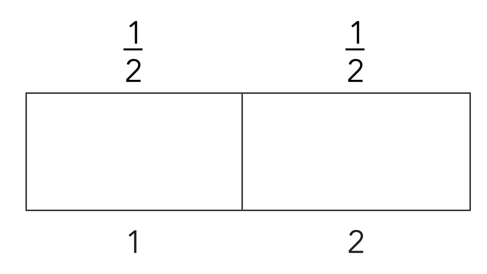
1. Ask a student to read Problem 1 aloud to the class. Tell students that the student work for this problem is correct and that their job is to make sense of the remainder so that they can answer the question correctly.

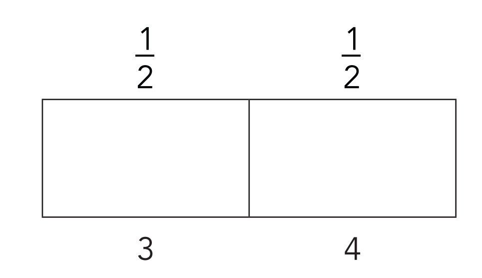
2. Have students Think-Pair-Share to decide on the correct answer and explain their thinking. Ask:



- *What does the remainder mean in this problem?*
- *How does the remainder affect the answer to the problem?*

3. Repeat the process for Problem 2. Then, explain that there is also a remainder in this problem. However, the 2 remaining balah el sham can be divided equally among the 4 children if they use fractions. Each child could get $\frac{1}{2}$ of a balah el sham, allowing them $2\frac{1}{2}$ balah el sham in total. Draw a model on the board.





Answer Key for Making Sense of Remainders

1. 12 trays
2. $2\frac{1}{2}$ balah el sham

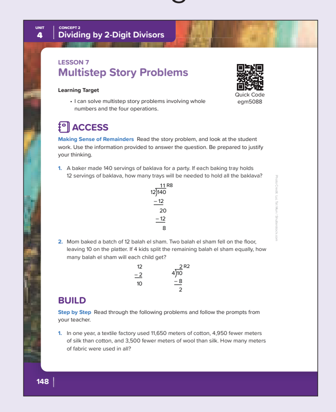
BUILD (40 min) 

Step by Step (20 min)

1. Discuss with students that sometimes a problem will require two or more steps to solve it. These are called multistep problems. Multistep problems sometimes involve more than one type of operation. Also, sometimes there may not be enough information given in a problem to answer the question that is asked. Additional steps are necessary to find all of the information in order to answer the question.

2. Ask students to read Problem 1 silently as you read it aloud. Model how to solve the problem. Do Think Alouds so students understand why you are taking the steps you are taking. Recommended steps are provided.

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UNIT 4 | CONCEPT 2 Dividing by 2-Digit Divisors

LESSON 7
Multistep Story Problems

Quick Code egm5088

Learning Target

- I can solve multistep story problems involving whole numbers and the four operations.

ACCESS

Making Sense of Remainders Read the story problem, and look at the student work. Use the information provided to answer the question. Be prepared to justify your thinking.

1. A baker made 140 servings of baklava for a party. If each baking tray holds 12 servings of baklava, how many trays will be needed to hold all the baklava?

$12\overline{)140}$ = 11 R8; − 12, 20, − 12, 8

2. Mom baked a batch of 12 balah el sham. Two balah el sham fell on the floor, leaving 10 on the platter. If 4 kids split the remaining balah el sham equally, how many balah el sham will each child get?

12 − 2 = 10; $4\overline{)10}$ = 2 R2; − 8, 2

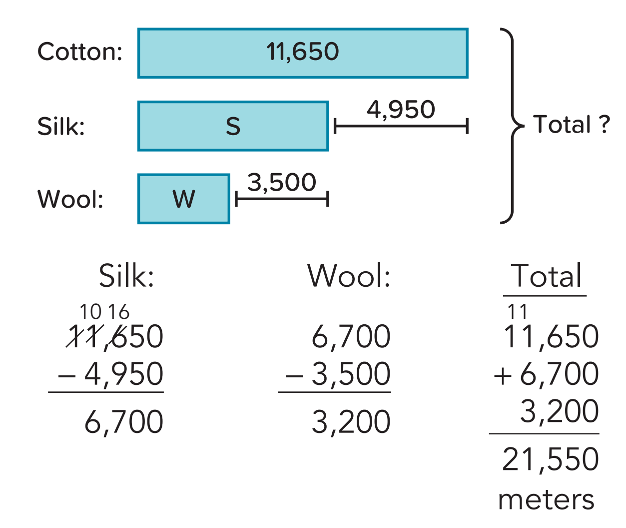
BUILD

Step by Step Read through the following problems and follow the prompts from your teacher.

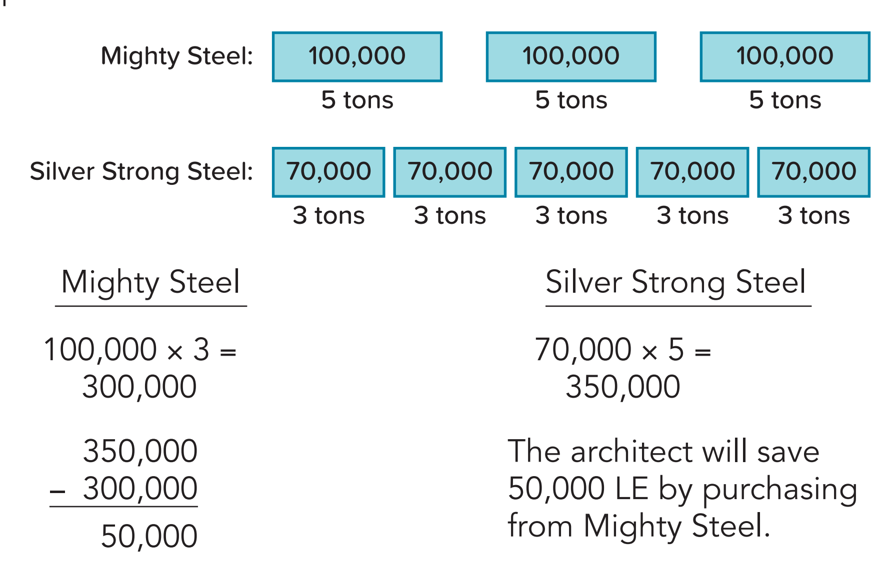
1. In one year, a textile factory used 11,650 meters of cotton, 4,950 fewer meters of silk than cotton, and 3,500 fewer meters of wool than silk. How many meters of fabric were used in all?

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- I am going to draw what I know. I will draw and label a bar to represent 11,650 meters of cotton. Is there enough information to answer the question? No, the amount of silk and wool are still unknown.
- From the problem, I know they used less silk than cotton, so I will draw a smaller bar to represent the amount of silk. I will label the amount of silk S. Since the problem says there are 4,950 fewer meters of silk than cotton, I will label the difference between the bars 4,950. Is there enough information to answer the question? No, the amount of wool is still unknown.
- The problem says there are 3,500 fewer meters of wool than silk. I will draw a bar that is smaller than the bar for silk to represent the amount of wool. I will label the amount of wool W and label the difference between the bars 3,500. Is there enough information to answer the question? It is now possible to subtract to find the amount of silk and wool and then to add to find the total amount of fabric.



3. Work with students to solve Problem 2. Encourage students to visualize what is happening in the problem and to identify what they know and do not know. Ask students to draw a picture or diagram to help them make sense of the problem.



Answer Key for Step by Step

1. 21,550 m (11,650 m of cotton + 6,700 m of silk + 3,200 m of wool)
2. 50,000 LE (350,000 LE (SSS) – 300,000 LE (MS) = 50,000 LE)

Solving Multistep Problems (20 min)

1. Divide students into groups of four and have them work collaboratively to solve the problems. Encourage students to reread the problem, draw a picture or a diagram, identify what they know and what they need to find out, and to reread the problem again to make sure they have answered the question being asked.
2. As students work, walk around the room and observe their progress and conversations. Offer help as needed. At the end of BUILD, go over the answers together.

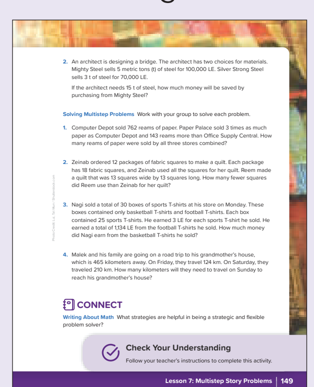
Answer Key for Solving Multistep Problems

1. 5,191 reams of paper (Paper Palace: $3 \times 762 = 2{,}286$ reams; Office Supply Central: $2{,}286 - 143 = 2{,}143$ reams; $762 + 2{,}286 + 2{,}143 = 5{,}191$ reams)
2. 47 fabric squares (Zeinab: $12 \times 18 = 216$ squares; Reem: $13 \times 13 = 169$ squares; $216 - 169 = 47$ squares)
3. 1,116 LE (Total earned for all the T-shirts: $30 \times 25 = 750$, 750×3 LE $= 2{,}250$ LE; Difference between total earned for each type of T-shirt: 2,250 LE (all T-shirts) – 1,134 LE (football T-shirts) = 1,116 LE
4. 131 km ($465 - 124 = 341$ km; $341 - 210 = 131$ km)




CONNECT (7 min)

Student Page 149



Writing About Math

Ask students to respond to the prompt.

Answer Key for Writing About Math

Answers may vary. Possible answers: Make sure to read the problem carefully multiple times, check to make sure my answer makes sense and is answering the question asked in the problem, and draw a diagram to help make sense of what information is known and unknown. Students may mention specific problem-solving strategies and ideas from the Thinking Like a Mathematician Anchor Chart.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their strategies with the whole group. Consider recording strategies on poster paper so that students can refer to them and use each other's strategies when problem solving.

PRACTICE

1. 720 minutes (Lifting weights: 45 min × 4 = 180 min; Running: 20 min × 7 = 140 min; Passing and scoring: 80 min × 5 = 400 min. 180 + 140 + 400 = 720 min)
2. 1,500 mL (4,255 – 2,755 = 1,500 mL)
3. 99 goals (Ahmed: 45 ÷ 3 = 15 goals; Ali: 45 – 6 = 39; Total: 45 (Mohammed) + 15 (Ahmed) + 39 (Ali) = 99 goals)

CONCEPT CHECK-IN AND REMEDIATION
Dividing by 2-Digit Divisors

DIGITAL



Quick Code: egmt5090

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Dividing by 2-Digit Divisors. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What strategies can be used to divide?
- What strategies can be used to evaluate the reasonableness of answers?
- What does it mean to be a strategic problem solver?

Lesson Learning Objective

- Students will correct misconceptions and errors related to dividing by 2-digit divisors.

Grade-Level Standards

5.A.3 Perform operations with multi-digit whole numbers and with decimals to Hundredths.

5.A.3.b Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

5.B.2.b Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may forget the importance of place value in division, particularly when recording the quotient.
- Students may underestimate while solving the problem. This may result in a quantity that is greater than the divisor.
- When using the standard algorithm, students may believe they are finished solving a problem and forget to bring down the next digit in the dividend.
- Students may struggle to understand when 0 is needed in the quotient. They may believe that they are finished with the problem when they cannot divide the new dividend by the divisor.
- Students may have difficulty performing the correct operations in the proper order when using the quotient, divisor, and remainder to check an answer to a division problem.
- Students may struggle to maintain place value columns throughout a problem. Consider providing students with graph paper.
- Students may solve the first part of a multistep problem but not subsequent parts if they do not thoroughly interpret the problem before attempting to solve.
- Students who rely on key words may misinterpret what is happening in the problem. For example, students may think that “in all” always means to add in a problem though it means multiplication. Example: *Avocados come 4 to a bag. Tamer buys 3 bags. How many avocados does he have in all?*

Remediation: Correcting Misconceptions

If . . .	**Then . . .**
Students stop solving a problem too soon and forget to bring down the next digit in the dividend.	Review Lessons 5 and 6 BUILD to reinforce the steps. Some students benefit from lightly crossing out each digit in the dividend to show that it has been used.
If . . .	**Then . . .**
Students are left with a difference that is greater than the divisor when using the standard algorithm, or write a remainder that is greater than the divisor.	Review Lessons 5 and 6 BUILD to reinforce how to use estimation to get to the closest multiple of the divisor without going over. See Lesson 6 Practice Challenge problem for an example of why the remainder should not be larger than the divisor.
If . . .	**Then . . .**
Students forget to use 0 in the quotient when the new dividend is less than the divisor and there are still digits to bring down in the dividend.	Review Lesson 6 ACCESS and remind students that zero is like any other digit: multiply, subtract, and look to the next place value. Provide additional practice problems with zeroes in the quotient.



UNIT

5

MULTIPLICATION AND DIVISION WITH DECIMALS

Theme 2 | Mathematical Operations and Algebraic Thinking

ESSENTIAL QUESTIONS

- What strategies can be used to multiply and divide decimals?
- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?
- What is the relationship between the size of the factors and the size of the product when multiplying decimals?

Photo Credit: Matej Kastelic / Shutterstock.com

Video Questions

Quick Code egmt5091

The Unit 5 Opener Video, Measuring Up, explores math around Egypt through multiplication and division with decimals. In this unit, students use strategies involving place value to multiply and divide decimals. They utilize decimals in investigating relationships between units in the metric system.

- How did multiplication and division with decimals help the students make sense of the world around them?
- What did the students discover about multiplying and dividing decimals?

Key Vocabulary

Quick Code egmt5092

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

area model, compatible numbers, dividend, divisor, equivalent, Identity Property of Multiplication, inverse operations, overestimate, partial products model, powers of ten, quotient, repeating decimal, standard algorithm for multiplication, terminating decimal, underestimate

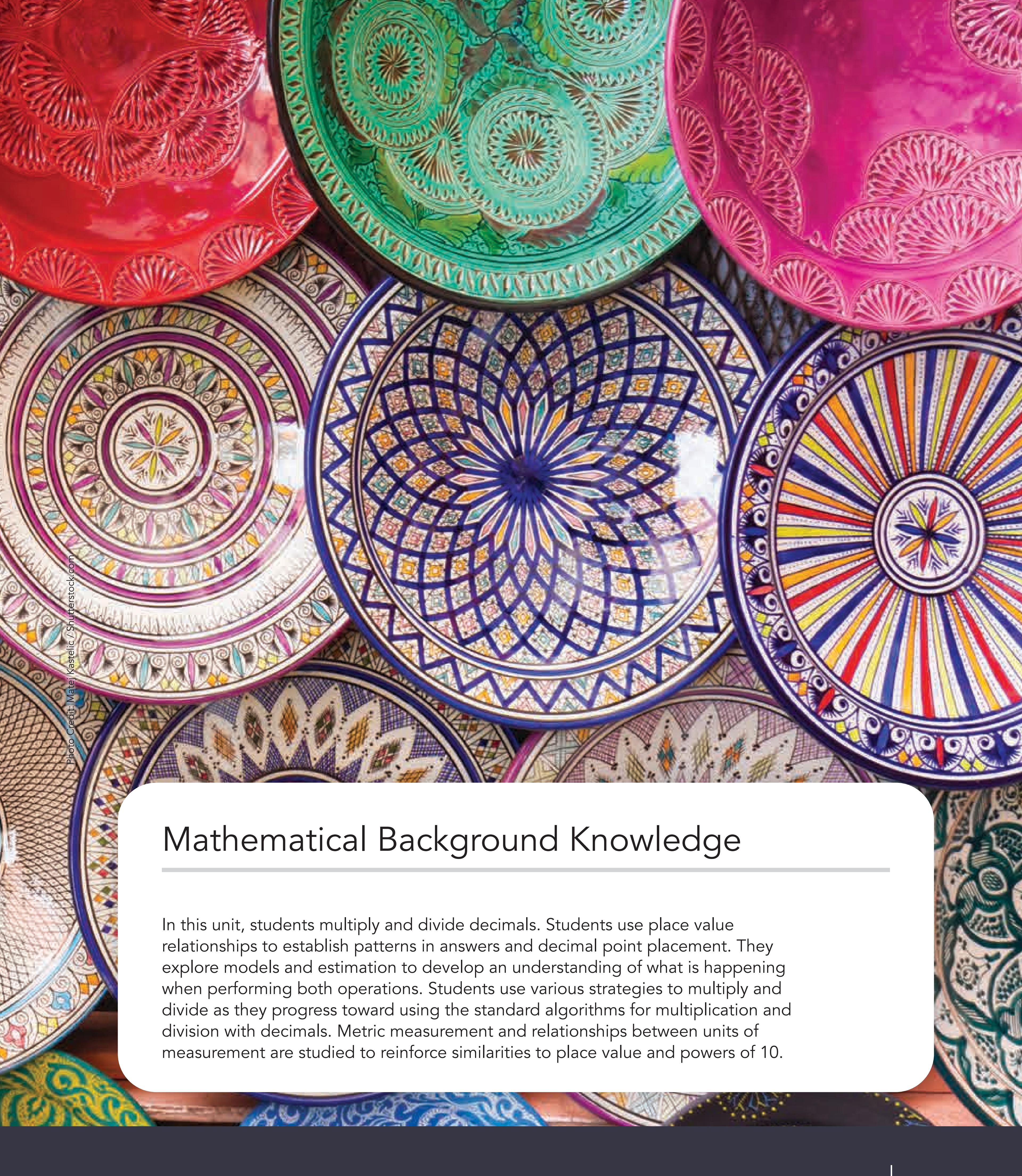


Photo Credit: Matej Kastelic / Shutterstock.com

Mathematical Background Knowledge

In this unit, students multiply and divide decimals. Students use place value relationships to establish patterns in answers and decimal point placement. They explore models and estimation to develop an understanding of what is happening when performing both operations. Students use various strategies to multiply and divide as they progress toward using the standard algorithms for multiplication and division with decimals. Metric measurement and relationships between units of measurement are studied to reinforce similarities to place value and powers of 10.

CONCEPT 1

Multiplying Decimals

Concept Overview

In Concept 1 Strategies for Multiplying Decimals, students begin by identifying patterns when multiplying by both whole number and decimal powers of 10. Students use physical models and estimation to recognize the effects of multiplying decimals on the size of a product. Once students have a conceptual understanding of what is occurring when decimals are multiplied, they begin to learn strategies for multiplication that support their progression toward using the standard algorithm. Students then apply their knowledge of decimals and multiplication to write measurements using decimals, convert measurements by multiplying by powers of 10, and solve multistep story problems involving measurement.

Concept Standards

5.A.3 Perform operations with multidigit whole numbers and with decimals to Hundredths.

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.A.4 Use place value to read and write decimals to the Thousandths place.

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

5.D.1.b Use unit conversions in solving multistep, real-world problems.

LESSON 1
Multiplying by Powers of Ten

Lesson Overview
In this lesson, students multiply by whole number powers of 10 and decimal powers of 10. They observe patterns in decimal placement as they multiply and work to build understanding of those patterns.

Lesson Essential Questions
- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?

Lesson Learning Objective
- Students will explain patterns when multiplying whole numbers by powers of ten.

Grade-Level Standards
5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by a power of 10 (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1000.

COMMON MISCONCEPTIONS AND ERRORS
- Students may be confused by which direction to move the decimal point when multiplying decimal numbers.
- Students may struggle when they need to use zeros as placeholders when multiplying by powers of 10. For example, $3 \times 100 = 300$, but $3 \times 0.01 = 0.03$ and not 0.300 or 0.003.



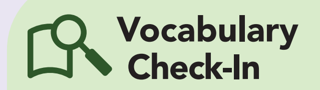


Missing Numbers
Ask students to work with a partner to fill in the missing numbers. Encourage students to study each equation carefully before deciding how to fill in each of the blanks. Discuss solutions with the whole class. Ask students what patterns they noticed as they solved the problems. The solutions are powers of 10. Problems 1 to 4 show numbers written in expanded form using powers of 10.

DIGITAL

Quick Code: egmt5093

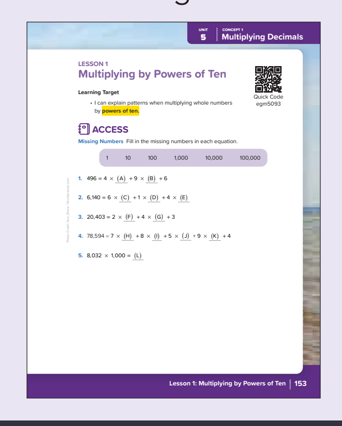
Materials List
- Centimeter ruler (optional)



Identity Property of Multiplication, powers of ten

VIDEO LESSON

Quick Code: egmt5094

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Looking for Patterns
Teacher Note for #1:

"Power of 10" refers to numbers such as 0.001, 0.01, 0.1, 10, 100, and 1,000. Students are not expected to use exponents. They should focus on the patterns they observe. Some students may describe the digit(s) as shifting to the left when they multiply by whole number powers of 10. When multiplying by decimal powers of 10, some students might describe the digit(s) as moving to the right. No matter how a student sees it, the decimal point is always between the Ones place and the Tenths place.

Answer Key for Missing Numbers

1. A. 100; B. 10
2. C. 1,000; D. 100; E. 10
3. F. 10,000; G. 100
4. H. 10,000; I. 1,000; J. 100; K. 10
5. L. 8,032,000

BUILD (40 min)  

Looking for Patterns (10 min)

1. Ask students to discuss with a partner the patterns they noticed in Set 1. The numbers going down each list get smaller by one place value. In whole numbers, more zeros at the end of the number makes the number larger. However, in decimal numbers, more zeros between the decimal point and the first digit in a decimal place make the number smaller.

2. Ask students to try Set 2 on their own and to check their work with their partner. Ask students how the two sets are the same and different. In Set 2, the number is multiplied by powers of 10. In Set 1, there was no regrouping (3×2). However, some of the answers in Set 2 need to be regrouped (25×0.1 is 25 Tenths, which is regrouped and written as 2.5). The answers get smaller by one place value in both sets.

3. In Unit 3, students learned patterns for zeros when multiplying by whole number powers of 10. Explain that this is actually the decimal point moving to the right in the answer (Example A). When multiplying by decimal powers of 10, the decimal point moves to the left for each decimal place in the factor (Example B).

Example A: 2 zeroes

$$25. \times 100 = 2{,}5.00.$$

Example B: 2 decimal places

$$25. \times 0.01 = 0.25.$$

Answer Key for Looking for Patterns

1. 25,000
2. 2,500
3. 250
4. 25
5. 2.5
6. 0.25
7. 0.025

Pencil Problem (10 min)

1. Ask students to look at the diagram of Manal's pencil. Discuss the relationship between millimeters and centimeters and why the measurement can be written as 15.2 cm.
2. Ask students to work with their Shoulder Partner to answer the questions. Ask students to share what they noticed about their results. We used powers of 10 to multiply. We moved decimal points left or right. The length of the pencil got very big or very small when multiplying by powers of 10.
3. If time allows, make this a hands-on activity by inviting students to use their own pencils, or ask students the following questions:



- *What if her pencil shrank to one hundredth of its current size? It would be very, very small or a little more than a millimeter (0.152 centimeter long).*
- *What if her pencil were 50 times longer than its current size? The length would be half the length of what it is in Problem 3.*

Pencil Problem
Teacher Note for #1:

Students will work more with measurement and decimals in Lessons 8 and 9.

Answer Key for Pencil Problem

1. 15.2 cm
2. 152 cm
3. 1,520 cm
4. 1.52 cm

Let's Try It and Let's Try More (20 min)

1. Write $4.2 \times 10 =$ _____ on the board. Ask students to describe something reasonable of which they could have four and two-tenths. Accept all reasonable answers.
2. Use the students' ideas to help them visualize the problem. Finish the equation. $4.2 \times 10 = 42$
3. Ask students to discuss how they can apply the Identity Property of Multiplication to solve the problem.
4. Write $360 \times 0.1 =$ _____ on the board and ask students to describe what the problem is asking. Find one-tenth of 360.
5. Ask students to explain how they would solve the problem. Accept all reasonable answers. Clear up misconceptions.
6. Write $7.4 \times 0.01 =$ _____ on the board and ask students questions to help them analyze the problem:



- *What is the problem asking? Find one hundredth of 7.4.*
- *Which way should the decimal point in 7.4 move? To the left*
- *How many places to the left should the decimal point in 7.4 move? Why? It should move two places to the left because there are two decimal places in 0.01.*

7. Point out that the digits in 7.4 seem to allow for the decimal point to move only one place to the left. To adjust for this, we must place a zero in the Tenths place to hold the value. $7.4 \times 0.01 = 0.074$

8. Leave the examples and rules on the board and ask students to complete the remaining problems independently or with a partner. If students are struggling, provide more examples. Consider doing parts of the table together.

Answer Key for Let's Try It

1. 42
2. 36
3. 0.074
4. 124.5
5. 6.021
6. 1.414

Answer Key for Let's Try More

1. A. 0.003; B. 0.03; C. 0.3; D. 3; E. 30; F. 300
2. G. 0.03; H. 0.3; I. 3; J. 30; K. 300; L. 3,000
3. M. 0.3; N. 3; O. 30; P. 300; Q. 3,000; R. 30,000

Student Page 156



CONNECT (5 min)



Hoda's Stride

Instruct students to read and solve the problem independently.

Answer Key for Hoda's Stride

Hoda will walk 720 m.

WRAP-UP (5 min)





Let's Chat About Our Learning

Ask students to discuss the three most important things they learned about multiplying decimals by powers of 10. Clear up any misconceptions.
Possible answers include moving a decimal point to the left makes numbers smaller; moving a decimal point to the right makes numbers larger; one-tenth is 10 times more than one hundredth; a whole number has a decimal point to the right of the Ones place; the decimal point moves to the right when multiplying by whole number powers of 10; the decimal moves to the left when multiplying by decimal powers of 10; zeros can be inserted in the Tenths and Hundredths places as placeholders.

PRACTICE

1. A. 45,000; B. 4,500; C. 450; D. 45; E. 4.5; F. 0.45; G. 0.045
2. H. 4,500; I. 450; J. 45; K. 4.5; L. 0.45; M. 0.045; *0.0045
3. N. 450; P. 45; Q. 4.5; R. 0.45; S. 0.045; *0.0045; *0.00045
4. T. 98,600; U. 9,860; V. 986; W. 98.6; X. 9.86; Y. 0.986; *0.0986

DIGITAL



Quick Code:
egmt5095

Materials List

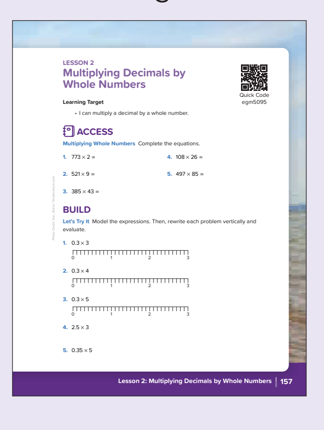
- Base 10 blocks or Base 10 manipulatives (see the Blackline Master)
- Spinners (1 per pair of students)
- Paper clips (1 per pair of students)

VIDEO LESSON



Quick Code:
egmt5096

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LESSON 2
Multiplying Decimals by Whole Numbers

Quick Code
egm5095

Learning Target

- I can multiply a decimal by a whole number.

ACCESS

Multiplying Whole Numbers Complete the equations.

1. $773 \times 2 =$
2. $521 \times 9 =$
3. $385 \times 43 =$
4. $108 \times 26 =$
5. $497 \times 85 =$

BUILD

Let's Try It Model the expressions. Then, rewrite each problem vertically and evaluate.

1. 0.3×3
2. 0.3×4
3. 0.3×5
4. 2.5×3
5. 0.35×5

Lesson 2: Multiplying Decimals by Whole Numbers | 157

LESSON 2
Multiplying Decimals by Whole Numbers

Lesson Overview

In this lesson, students use Base 10 models and number lines to build conceptual understanding of how to multiply decimals by whole numbers. They then progress to using the standard algorithm for multiplication. Students use estimation to help them determine the proper placement of the decimal point in products.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?

Lesson Learning Objective

- Students will multiply a decimal by a whole number.

Grade-Level Standard

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

COMMON MISCONCEPTIONS AND ERRORS

- Students may read the decimal 1.25 as "one point two five." Students should be corrected to read decimals properly, referencing the decimal point and place value (for example, "one and twenty-five hundredths").
- Students may be confused when a product ends in zero. Students should be reminded that the final zero is not necessary, though including it is not incorrect.



ACCESS (5 min)



Multiplying Whole Numbers

Ask students to solve the problems. Go over the answers together. Tell students that they will be multiplying whole numbers by decimals today. Encourage students to look for similarities to whole number multiplication.

Answer Key for Multiplying Whole Numbers

1. 1,546
2. 4,689
3. 16,555
4. 2,808
5. 42,245

BUILD (45 min) 

Let's Try It (15 min)

1. Write Problem 1 on the board. Remind students that multiplication can also be represented as repeated addition. Write $0.3+0.3+0.3$ on the board.
2. Direct students to the number line. Emphasize that 3 Tenths 3 times is 9 Tenths. Write $0.3\times3=0.9$ and $0.3+0.3+0.3=0.9$ on the board.
3. Ask students to show another hop of 3 Tenths on the number line (Problem 2). Explain that 3 Tenths, 4 times, is 12 Tenths. Point out on the number line that the number 12 Tenths is already regrouped to 1.2. Write $0.3\times4=1.2$ on the board. Show the problem as a repeated addition problem.
4. Review how to use Base 10 blocks for decimals. Use the flats to represent Ones, the rods to represent Tenths, and the unit cubes to represent Hundredths.
5. Ask the students to represent 3 Tenths with their blocks. 3 rods Ask the students to use their blocks to show 3 groups of 3 Tenths. Confirm each student has 9 rods out and reaffirm $0.3\times3=0.9$. Ask students to represent 0.3×4 with the Base 10 blocks. Confirm that each student has 12 Tenths. Ask students to regroup their rods into 1 flat and 2 rods.
6. Write Problem 3 on the board. Emphasize that when multiplying a whole number by a decimal with digits in the Tenths place, the Tenths place will be represented in the product as well.
7. Direct students in modeling the problem and writing 0.3×5 vertically in their Student Materials. Point out that the decimal points in the factor and the solution line up.
8. Ask students how this problem is related to basic multiplication facts. If $3\times5=15$, then 0.3×5 cannot also be 15. Model this estimation on where the decimal point should be placed in the product on the board. Confirm the correct answer.
9. Write Problem 4 on the board vertically. Ask students to use Base 10 blocks to model the problem.

Let's Try It
Teacher Note for #4:

Using Base 10 blocks for decimals:

Flats represent Ones.

Rods represent Tenths.

Unit Cubes represent Hundredths.

Let's Try It
Teacher Note for #8:

Lining up the decimal points is a familiar skill with adding and subtracting decimals. In multiplying decimals, the decimal points only line up when multiplying a decimal by a whole number. By emphasizing the placement of decimal points, students maintain focus on the value of the numbers.

10. Guide students in estimating to check the reasonableness of their answers. Ask whether 2.5 × 3 should equal 75, 7.5, or 0.75. Explain that 75 is too large and 0.75 is less than 2.5, which is not reasonable. Ask a volunteer to evaluate the expression on the board.

11. Ask students to solve Problem 5 on their own.

Answer Key for Let's Try It

1. 0.9
2. 1.2
3. 1.5
4. 7.5
5. 1.75

Make the Greatest Product (30 min)

1. Assign students to work with a partner and distribute one spinner and a paper clip to each pair of students. Read the directions with students. If necessary, model how to play a round of the game.
2. Before playing, encourage students to think about different strategies for producing the greatest product. Point out to students that each round has a variety of places to record digits, and the decimal points are in various positions so they can try different strategies each round.
3. If time permits, ask students to discuss strategies they used during the game. Ask students to switch two digits in one of their problems to see how the product changes.

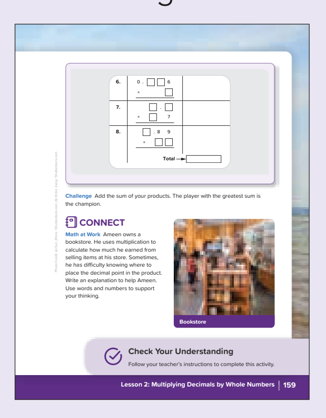
Whiteboard: Make the Greatest Product

Ask students to record their results from Make the Greatest Product.

Answer Key for Whiteboard: Make the Greatest Product

Answers will vary.

Student Page 159







Math at Work

Ask students to respond to the CONNECT problem.

Answer Key for Math at Work

Accept all appropriate responses.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask volunteers to share their CONNECT responses. Invite students to share their ideas about the similarities and differences between multiplying whole numbers and decimals.

PRACTICE

1. 4.8
2. 25.2
3. 111
4. 0.56
5. 21.96
6. 3.15 L

Challenge 1,917.5 LE

DIGITAL



Quick Code: egmt5097

Materials List

- Crayons

VIDEO LESSON



Quick Code: egmt5098

LESSON 3
Multiplying Tenths by Tenths

Lesson Overview

In this lesson, students explore the results when a number less than one is multiplied by another number less than one. They use Base 10 grids to model multiplication of Tenths.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?
- What is the relationship between the size of the factors and the size of the product when multiplying decimals?

Lesson Learning Objectives

- Students will explain patterns when multiplying two decimals to the Tenths place.
- Students will use models to represent decimal multiplication.

Grade-Level Standards

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

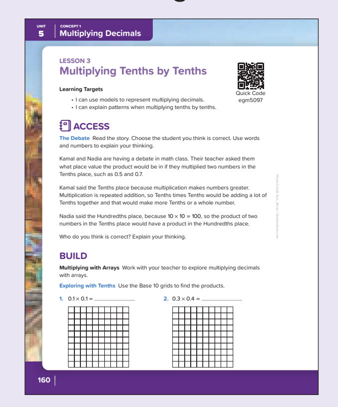
5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.B.2.d.1 Interpret multiplication as scaling (resizing) by comparing the size of a product to the size of one factor, based on the size of the other factor, without performing the indicated multiplication.

COMMON MISCONCEPTIONS AND ERRORS

Students may assume multiplication always produces larger numbers.

Student Page 160





ACCESS (10 min)



The Debate

Ask students to read the story, decide who is correct, and explain their thinking. Instruct students to keep their thoughts on the debate in mind as they explore multiplication using arrays and Base 10 grids.

Answer Key for The Debate

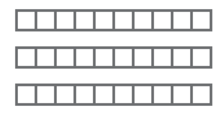
Answers will vary. Accept all reasonable responses and continue the discussion in Multiplying with Arrays and Exploring with Tenths.

BUILD (40 min)

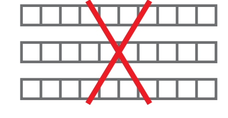


Multiplying with Arrays (10 min)

1. Remind students that an array displays objects in equal rows and columns.
2. Remind students that they multiplied decimals by whole numbers in the previous lesson. Draw an array showing 0.3×4 using rods to represent Tenths.
3. Erase one group of 0.3 at a time until only one group remains. Ask students to describe how the problem is changing. The problem began as 0.3×4, then became 0.3×3, then 0.3×2, and is now 0.3×1.

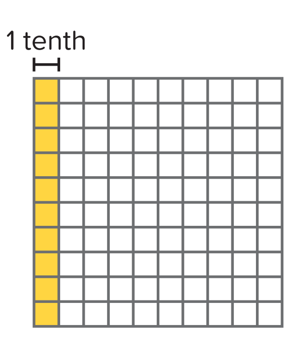


4. Consider Kamal's logic that multiplication makes numbers larger. Point out that the products to the previous problems were all larger than 0.3, but that the product of 0.3×1 is equal to 0.3. Suggest that Kamal's logic makes sense when at least one of the factors is greater than 1.
5. Erase or cross out 3 columns of the array. Explain that the array now shows 0.3 times a number less than 1. Ask students to discuss the array with their Shoulder Partner.

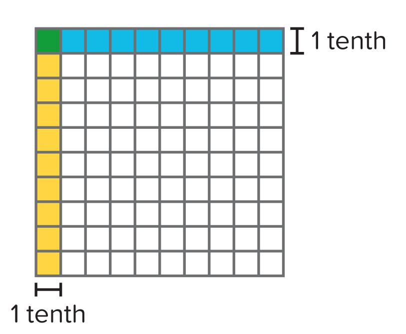


Exploring with Tenths (30 min)

1. Ask students to choose two different colored crayons. Explain that the diagram shows a Base 10 flat, which will equal one whole throughout this lesson. Instruct students to color the first column of the grid to represent 0.1, the first factor in the problem.



2. Instruct students to use their other crayon to color the first row of the grid to represent 0.1, the second factor.



3. Explain that the overlapping colors show $0.1 \times 0.1 = 0.01$. Write $0.1 \times 0.1 = 0.01$ on the board.

4. Reinforce this solution with estimation. Write $1 \times 1 = 1$ on the board. Ask whether it makes sense for 0.1×0.1 to equal 1, 0.1, or 0.01. Students may note that 1 is too large because 1×1 equals 1 and both factors are less than 1. Since $0.1 \times 1 = 0.1$, the product must be less than 1.

5. Repeat the process for Problem 2.

6. Instruct students that the overlapping colors form an array that shows 0.3×0.4. Ask students to count the squares in the array they created. Reinforce that the squares represent Hundredths. Ask students to use estimation to check the reasonableness of their answers. Since $3 \times 4 = 12$ and $0.3 \times 4 = 1.2$, then $0.3 \times 0.4 = 0.12$.

7. Direct students to the next problem. Suggest that Nadia's thinking may be correct because the products so far have been in the Hundredths. Ask volunteers to provide the steps to represent 0.5×0.2. All students should follow their classmates' directions, shading in the models in their Student Materials. Provide correction as needed.

8. Repeat the process of counting the arrays, writing the equation on the board, and estimating to check the reasonableness of the answer. Since $5 \times 2 = 10$ and $0.5 \times 2 = 1.0$, then $0.5 \times 0.2 = 0.1$.

9. Ask the students to reconsider Nadia and Kamal's debate, and to discuss their thinking now after doing these problems. Nadia is correct because the product is smaller and will go to the Hundredths place. However, sometimes the product can be regrouped as Tenths.

10. Direct students to complete the rest of the problems with a partner.

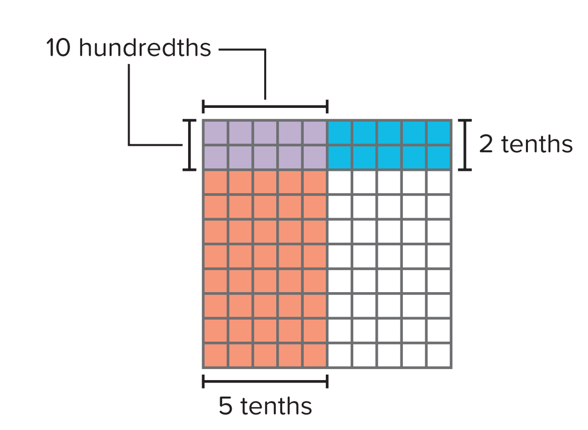
Answer Key for Exploring with Tenths

1. 0.01

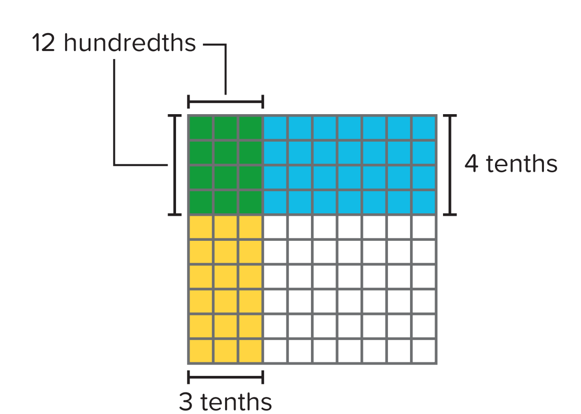
1 tenth

1 tenth

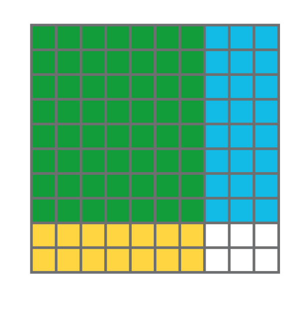
3. 0.1



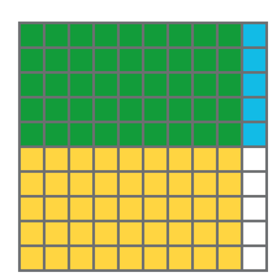
2. 0.12



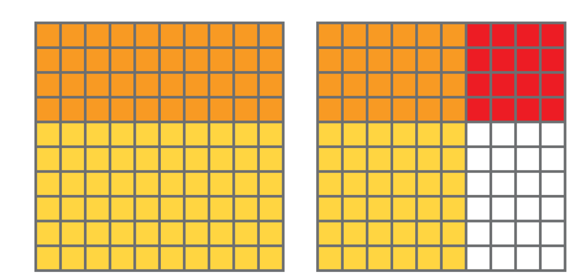
4. 0.56



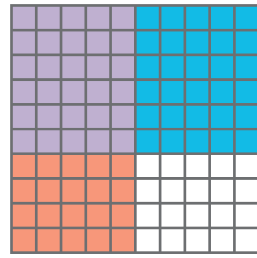
5. 0.45

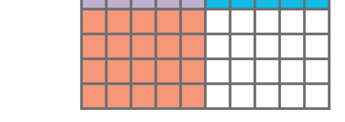


7. 0.64



6. 0.3





Student Page 162



CONNECT (7 min)



Writing About Math

Instruct students to read the prompt and record their response.

Answer Key for Whiteboard: Writing About Math

Answers will vary.

WRAP-UP (3 min)

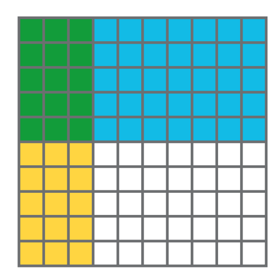


Let's Chat About Our Learning

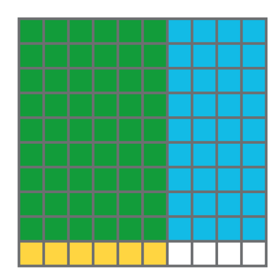
Ask volunteers to share their response to CONNECT. Encourage students to ask each other questions and to help each other clear up misconceptions.

PRACTICE

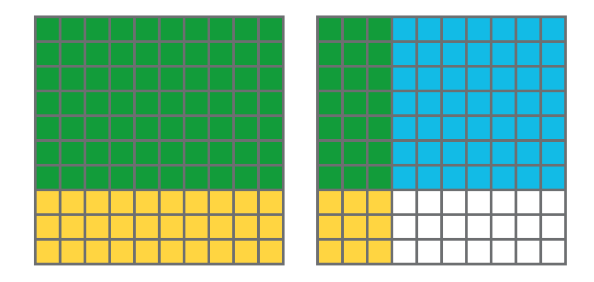
1. 0.15



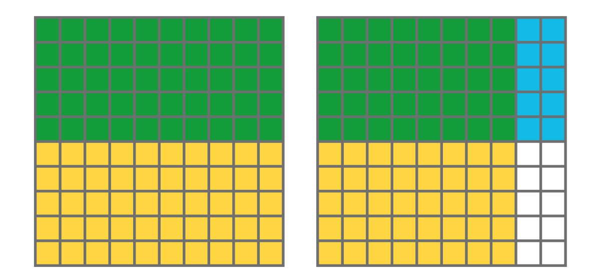
2. 0.54



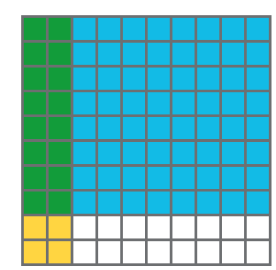
3. 0.91



4. 0.9



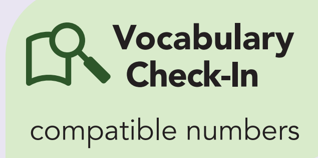
5. 0.16



DIGITAL



Quick Code: egmt5099



compatible numbers

VIDEO LESSON



Quick Code: egmt5100

LESSON 4
Estimating Decimal Products

Lesson Overview

In this lesson, students estimate products by rounding or using other compatible numbers. They use their reasoning about decimals to determine how close their estimates are to the actual answer.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What is the relationship between the size of the factors and the size of the product when multiplying decimals?

Lesson Learning Objective

- Students will estimate products of decimals.

Grade-Level Standards

5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

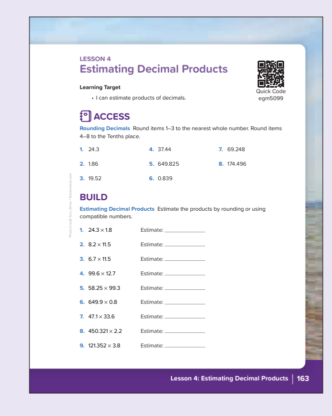
5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.B.2.d.i Interpret multiplication as scaling (resizing) by comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.

COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused when rounding down and mistakenly decrease the digit in the place to which it is being rounded instead of keeping the digit the same.
- Students may believe that the only way to estimate is by using rounding. Using compatible numbers sometimes provides a closer estimate than rounding.

Student Page 163





ACCESS (10 min)



Rounding Decimals

Ask students to round the decimals to the given place value. Ask students to compare their answers with a partner and to make corrections if necessary. Discuss Problems 7 and 8. Discuss why it might be helpful to round these numbers to the nearest Hundredth when estimating products. Numbers that end in .25 and .5 are compatible numbers because some of their multiples make whole numbers. Point out that multiplying 0.25 by any multiple of 4, and 0.5 by any multiple of 2, will equal whole numbers.

Answer Key for Rounding Decimals

1. 24
2. 2
3. 20
4. 37.4
5. 649.8
6. 0.8
7. 69.25
8. 174.5

BUILD (40 min)



Estimating Decimal Products (20 min)

1. Write Problem 1 horizontally on the board. Tell students they will be estimating the product.
2. Ask students to round 24.3 to the nearest whole number. 24 Write 24 under 24.3. Ask students to round 1.8 to the nearest whole number. 2 Write 2 under 1.8. Ask students to multiply 24 by 2. 48
3. Explain to students that it is possible to be more specific with the estimate. Since 1.8 is between 1 and 2, 24.3×1.8 will be between 24 (24×1) and 48 (24×2). Since 1.8 is closer to 2, the actual answer will be closer to 48. Explain that this strategy is called using compatible numbers.
4. Ask students for another number they could use instead of 24.3. 24.5 or 24.25 Although 24.3 does not round to either of these numbers, they are compatible numbers because they are easy to work with in this problem.
5. Discuss how to use these compatible numbers to estimate the product of 24.3×1.8. $24.5 \times 2 = 49$ and $24.25 \times 2 = 48.5$ Discuss how these estimates would compare to the actual answer. They are both greater than the actual answer because 1.8 was rounded up to 2.
6. Repeat the process with Problems 2 and 3.
7. Ask students to complete the remaining problems with a partner. Encourage students to discuss with each other how they are rounding the factors or what compatible numbers they are using.

Answer Key for Estimating Decimal Products

1. about 48
2. about 96
3. about 77
4. about 1,300
5. about 5,800
6. about 650
7. about 1,500
8. about 900
9. about 484

Meal Planning (20 min)

1. Explain that Ezz is a public health nutritionist and is putting together different shopping lists for his clients to help them budget their money for providing healthy meals for one month. Direct students to the chart that lists the foods and their costs. Explain that because market costs vary, it would be difficult for Ezz to create options that are exactly 2,000 LE. Instead, it is best to estimate the cost.

2. Direct students to the example. Explain that the Running Total column adds the previous line's total to the current line's total. Explain that this helps keep track of expenses as they progress. Ask students to choose an item from the list to add to the example. Model on the board how to fill in each box of the chart as the students follow along in their materials. Direct students to add this new item's total to the previous running total of 190 to determine the new running total.

Food Item	Actual Cost LE	Rounded Cost LE	Quantity	Equation	Running Total Estimated Cost LE
Eggs	21.60	22	10	$22 \times 10 = 220$	220
Cheese	5.19	5	30	$5 \times 30 = 150$	$220 + 150 = 370$
Bread	2.40	2	12	$2 \times 12 = 24$	$370 + 24 = 394$

3. Instruct students to work with a partner to create three different meal plan options. If time permits, lead a class discussion when students have finished. Ask students what was surprising about meal planning for an entire month or how estimating was helpful. Consider asking students if rounding is an effective strategy for estimating the cost of items Rounding is not always effective if a price rounds down. If you estimate using rounding, you risk not having enough money to pay for your items. Sometimes using a compatible number is more appropriate.

Answer Key for Meal Planning

Answers will vary.



CONNECT (5 min)



Student Page 166



Math at Work

Ask students to solve the problem. If necessary, remind students that area equals length times width.

Answer Key for Math at Work

$3.8 \times 15.2 \rightarrow 4 \times 15 = 60$

$60 \times 4 = 240$

Nadia needs paint to cover about 240 square meters.

WRAP-UP (5 min)



Let's Chat About Our Learning

Ask students to share their CONNECT responses and explain their estimation strategies. Encourage students to ask each other questions and help each other clear up misconceptions.

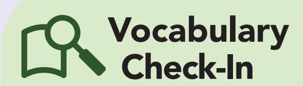
PRACTICE

1. 28
2. 180
3. 1,760
4. 640
5. 5,501

DIGITAL



Quick Code:
egmt5101



Vocabulary Check-In

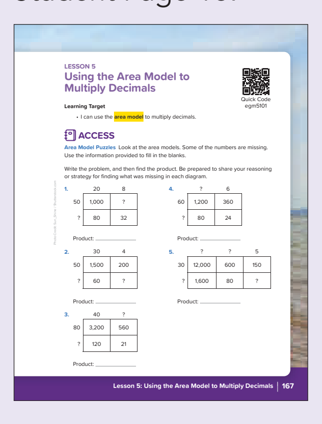
area model, partial products model

VIDEO LESSON



Quick Code:
egmt5102

Student Page 167



LESSON 5
Using the Area Model to Multiply Decimals

Quick Code
egm5101

Learning Target
- I can use the **area model** to multiply decimals.

ACCESS

Area Model Puzzles Look at the area models. Some of the numbers are missing. Use the information provided to fill in the blanks.

Write the problem, and then find the product. Be prepared to share your reasoning or strategy for finding what was missing in each diagram.

1.

	20	8
50	1,000	?
?	80	32

Product: ______

2.

	30	4
50	1,500	200
?	60	?

Product: ______

3.

	40	?
80	3,200	560
?	120	21

Product: ______

4.

	?	6
60	1,200	360
?	80	24

Product: ______

5.

	?	?	5
30	12,000	600	150
?	1,600	80	?

Product: ______

Lesson 5: Using the Area Model to Multiply Decimals | 167

LESSON 5
Using the Area Model to Multiply Decimals

Lesson Overview

In this lesson, students use area models to multiply decimals.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?

Lesson Learning Objective

- Students will use the area model to multiply decimals.

Grade-Level Standard

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

COMMON MISCONCEPTIONS AND ERRORS

- Students may misplace the decimal point in partial products or the final product.
- Students may have difficulty decomposing a factor properly according to the value of each of its digits.
- Students may have trouble understanding that multiplying Tenths and Hundredths results in Thousandths and that multiplying Hundredths by Hundredths results in Ten-Thousandths.

ACCESS (10 min)



Area Model Puzzles

Ask students to complete the problems. Provide additional guidance as needed. Review each problem together. Ask students to share their reasoning or strategy for finding what was missing in each diagram.

Answer Key for Area Model Puzzles

1.

	20	8
50	1,000	400
4	80	32

Product 1,512

2.

	30	4
50	1,500	200
2	60	8

Product 1,768

3.

	40	7
80	3,200	560
3	120	21

Product 3,901

4.

	20	6
60	1,200	360
4	80	24

Product 1,664

5.

	400	20	5
30	12,000	600	150
4	1,600	80	20

Product 14,450

BUILD (40 min)

Extending Multiplication Patterns (10 min)

1. Ask students to look at Problem 1 and share what they notice and what they wonder.
2. Guide students as needed in completing the problems. Encourage students to think about place value and to use estimation to determine what is reasonable when placing the decimal point in each answer. Ask students to describe what they notice about the value of the products when Tenths are multiplied by Hundredths (Thousandths) and when Hundredths are multiplied by Hundredths (Ten-Thousandths). Discuss why some problems have the same product.

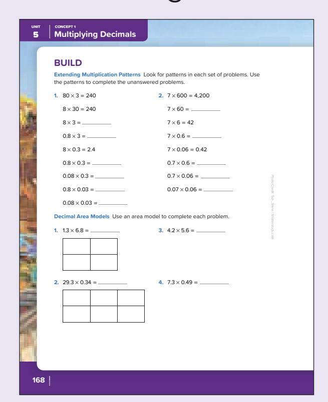
Answer Key for Extending Multiplication Patterns

1. 24; 2.4; 0.24; 0.024; 0.024; 0.0024
2. 420; 4.2; 0.42; 0.042; 0.0042

Decimal Area Models (30 min)

1. Write $1.3 \times 6.8 =$ _____ on the board. Ask a student to read aloud the directions and Problem 1. Explain that the process of multiplying decimal numbers with an area model is similar to multiplying whole numbers with an area model.

Student Page 168



Extending Multiplication Patterns
Teacher Note for #2:

It is not important at this time that students develop fluency with the Ten-Thousandths place. The focus is on helping students understand that decimal multiplication results in smaller decimal numbers, unlike whole number multiplication.

2. Ask students to estimate the product. About 7 Direct students to break apart each factor according to the value of its digits. Since there are 2 places in each factor, the area model will be 2 by 2. Guide students through completing the area model by asking students to solve the calculations along the way.

1.3×6.8

	6	0.8
1	6	0.8
0.3	1.8	0.24

$$\begin{array}{r} \overset{1}{6}.00 \\ 0.80 \\ 1.80 \\ +\ 0.24 \\ \hline 8.84 \end{array}$$

$1.3 \times 6.8 = 8.84$

3. Repeat the process for Problem 2.

29.3×0.34

	20	9	0.3
0.3	6	2.7	0.09
0.04	0.8	0.36	0.012

$$\begin{array}{r} \overset{1}{6}.\overset{1}{0}00 \\ 2.700 \\ 0.090 \\ 0.800 \\ 0.360 \\ +\ 0.012 \\ \hline 9.962 \end{array}$$

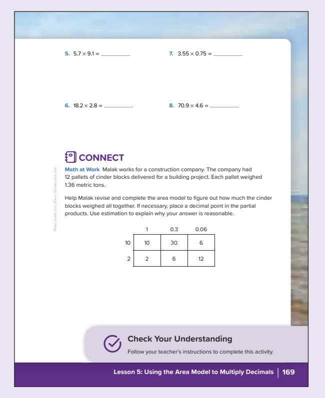
$29.3 \times 0.34 = 9.962$

4. Ask students to complete the rest of the problems in pairs or small groups.

Answer Key for Decimal Area Models

1. 8.84
2. 9.962
3. 23.52
4. 3.577
5. 51.87
6. 50.96
7. 2.6625
8. 326.14

Student Page 169



CONNECT (7 min) 

Math at Work

Ask students to respond to the prompt.

Answer Key for Math at Work

16.32 metric tons; accept all reasonable explanations

	1	0.3	0.06
10	10	3.0	0.6
2	2	0.6	0.12

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to discuss how they used place value to solve problems in today's lesson.
Students used place value to decompose each factor into its parts. They also used place value to multiply to find each of the partial products in the area model.

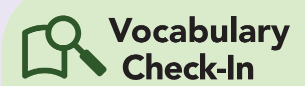
PRACTICE

1. 23.5
2. 8.84
3. A. 0.07; B. 0.12; C. 30.094
4. 10.22 m^2
5. 72 km

DIGITAL



Quick Code:
egmt5103



Vocabulary Check-In

standard algorithm for multiplication

VIDEO LESSON



Quick Code:
egmt5104

LESSON 6
Multiplying Decimals through the Hundredths Place

Lesson Overview

In this lesson, students multiply decimal numbers through the Hundredths place using the standard algorithm. They build understanding of the process by making connections to whole number multiplication and to the area model for multiplication.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?

Lesson Learning Objectives

- Students will use the standard algorithm to multiply decimals through the Hundredths place.
- Students will use estimation to check the reasonableness of their answers.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.B.2.d.1 Interpret multiplication as scaling (resizing) by comparing the size of a product to the size of one factor, based on the size of the other factor, without performing the indicated multiplication.

COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes believe it is necessary to line up decimal points and places when setting up multiplication problems, which may cause confusion as they solve. Putting the factor with the most places on top means fewer partial products.
- Students may forget to erase previous regrouping and to use a zero as a placeholder when calculating a second partial product.
- Students may be confused when a product ends in zero.



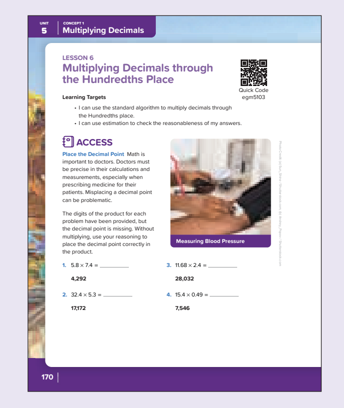
ACCESS (10 min)



Place the Decimal Point

Go over the directions with students. Ask students to complete the learning activity. Then, ask students to share their answers and explain the strategies they used to place the decimal points.

Student Page 170



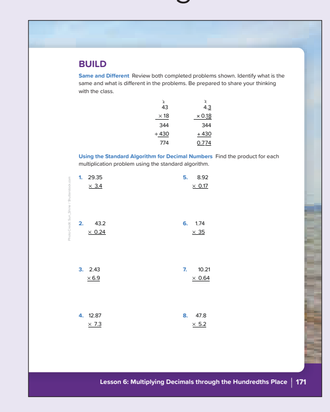
Answer Key for Place the Decimal Point

1. 42.92
2. 171.72
3. 28.032
4. 7.546

BUILD (40 min)



Student Page 171



Same and Different (5 min)

1. The goal of this brief activity is for students to realize that multiplying using the standard algorithm with decimals is similar to multiplying with whole numbers. The only difference is that the decimal point must be placed in the product after multiplying.
2. Give students a minute to look at the multiplication problems. Ask students to discuss similarities and differences between the two problems.

Answer Key for Same and Different

Both problems have the same digits, but one includes decimals, which changes the value of the number. The same goes for the products—although the digits are the same, one includes decimals and therefore changes the value of the number.

Using the Standard Algorithm for Decimal Numbers (35 min)

1. Discuss with students that the process of using the standard algorithm for decimal numbers is the same as the process for whole numbers. Place value and estimation can help us determine where the decimal goes in the product.
2. Write Problem 1 on the board vertically. Be sure to note that when multiplying with decimals there is no need to line up the place values. Putting the number with more digits on top means fewer partial products. Work with students to estimate the product. Then, model the standard algorithm for multiplication of decimal numbers.

3. After adding the partial products, place the decimal point based on the estimate students made before solving the problem. Model shifting the decimal point until the product makes sense.

4. Instruct students to solve the rest of the problems using the standard algorithm. Remind them to estimate to check the reasonableness of their answers.

Answer Key for Using the Standard Algorithm for Decimal Numbers

1. 99.79
2. 10.368
3. 16.767
4. 93.951
5. 1.5164
6. 60.9
7. 6.5344
8. 248.56

Student Page 172




CONNECT (7 min)

Writing About Math

Ask students to respond to the prompt.

Answer Key for Writing About Math

Accept all reasonable explanations. Students may notice that both strategies work.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt, along with their explanations.

PRACTICE

1. 31.08
2. 67.36
3. 256.96
4. 177.072
5. 273.564

Writing About Math Teacher Note:

This question in Writing About Math allows students to start to discover a new way to place the decimal. This will be further covered in Lesson 7, so the accuracy of responses is not as important as allowing students to reason about the placement of the decimal point. Encourage students to look back at the problems they solved in this lesson to see when Doha's strategy appears to work and when it does not.

LESSON 7
Multiplying Decimals through the Thousandths Place

DIGITAL



Quick Code:
egmt5105

VIDEO LESSON



Quick Code:
egmt5106

Lesson Overview

In this lesson, students continue to use the standard algorithm to multiply decimals through the Thousandths place. The goal is for students to continue to build fluency with multiplication while working with smaller decimal numbers.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?

Lesson Learning Objectives

- Students will use the standard algorithm to multiply decimals through the Thousandths place.
- Students will use estimation to check the reasonableness of their answers.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.B.2.d.1 Interpret multiplication as scaling (resizing) by comparing the size of a product to the size of one factor, based on the size of the other factor, without performing the indicated multiplication.

COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes believe it is necessary to line up decimal points and places when setting up multiplication problems.
- Students may forget to erase previous regrouping and to use a zero as a placeholder when calculating a second partial product.
- Students may be confused when a product ends in zero.



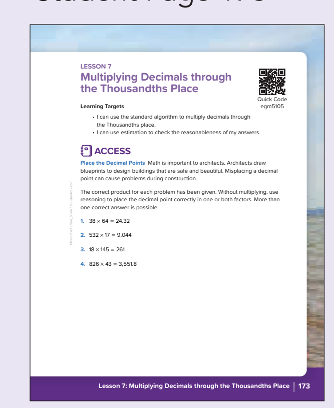
ACCESS (10 min)



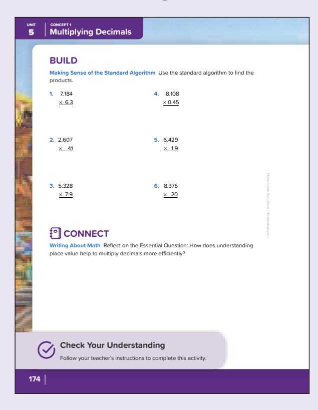
Place the Decimal Points

Go over the directions with students. Ask students to complete the learning activity. Then, ask students to share their answers and explain the strategies they used to place the decimal points.

Student Page 173



Student Page 174



Answer Key for Place the Decimal Points

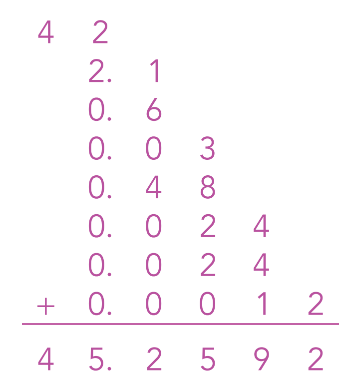
1. 3.8 × 6.4; 0.38 × 64; 38 × 0.64
2. 5.32 × 1.7; 0.532 × 17; 53.2 × 0.17
3. 18 × 14.5; 1.8 × 145
4. 826 × 4.3; 82.6 × 43

BUILD (40 min) 

Making Sense of the Standard Algorithm

1. Explain to students that they are going to learn more about using the standard algorithm to multiply decimals.
2. Write Problem 1 vertically on the board. Ask students to provide the steps for using an area model to solve the problem. Record the work on the board.

	7	0.1	0.08	0.004
6	42	0.6	0.48	0.024
0.3	2.1	0.03	0.024	0.0012



3. Point out that the area model requires a 4 by 2 array and results in 8 partial products. Explain that the more partial products there are, the more likely mistakes will be made.
4. Discuss how the standard algorithm is the most efficient strategy. This is because it combines several steps along the way, making it a quicker process with fewer partial products. Model using the standard algorithm to solve the problem.
5. Ask students to count the decimal places in the factors and explain where to place the decimal point in the product.
6. Ask students to explain why it is possible to count the decimal places in both factors to determine how many decimal places will be in the product.
7. Ask students to complete the rest of the problems independently. Encourage students to estimate before multiplying and to count the decimal places after multiplying to see if both methods give the same answer.

8. With about 5 minutes remaining, discuss Problems 4 and 6. Explain that when products end with zero in a decimal place, the final zero (or zeros) can be removed after placing the decimal point without changing the value of the answer.

Answer Key for Making Sense of the Standard Algorithm

1. 45.2592
2. 106.887
3. 42.0912
4. 3.6486
5. 12.2151
6. 167.5



CONNECT (7 min)



Writing About Math

Ask students to respond to the CONNECT prompt.

Answer Key for Writing About Math

Students may mention that they are decomposing numbers by place values in order to multiply them. They may also mention that there is a place holder 0 in the standard algorithm. This is because, in the second partial product, they are multiplying by a digit in a place that is 10 times the value of the place to the right.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Encourage students to ask each other questions and to help each other clear up misconceptions.

PRACTICE

1. 124.935
2. 9.576
3. 0.86363
4. 55.068
5. 44.7454

DIGITAL



Quick Code: egmt5107

Materials List

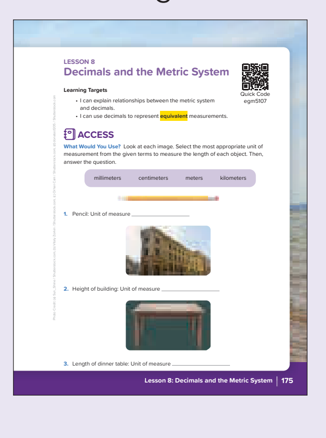
- Ruler (optional)
- Balance or scale (optional)
- Graduated cylinder (optional)

VIDEO LESSON



Quick Code: egmt5108

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LESSON 8
Decimals and the Metric System

Learning Targets

- I can explain relationships between the metric system and decimals.
- I can use decimals to represent equivalent measurements.

ACCESS

What Would You Use? Look at each image. Select the most appropriate unit of measurement from the given terms to measure the length of each object. Then, answer the question.

millimeters | centimeters | meters | kilometers

1. Pencil: Unit of measure ____________
2. Height of building: Unit of measure ____________
3. Length of dinner table: Unit of measure ____________

Quick Code egm5107

Lesson 8: Decimals and the Metric System | 175

LESSON 8
Decimals and the Metric System

Lesson Overview

In this lesson, students relate the metric system to the place value system and use decimals to represent equivalent measurements. Exploring relationships between mathematical concepts helps students see that mathematics is full of connections, patterns, and rules they can use to solve problems.

Lesson Essential Question

- How are decimals used in measurement?

Lesson Learning Objectives

- Students will explain relationships between the metric system and decimals.
- Students will use decimals to represent equivalent measurements.

Grade-Level Standards

5.A.4 Use place value to read and write decimals to the Thousandths place.

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

COMMON MISCONCEPTIONS AND ERRORS

Students may have difficulty determining which way to move the decimal point. This is likely when they are writing a smaller unit of measurement as a larger unit or writing a larger unit as a smaller unit.



ACCESS (10 min)



What Would You Use?

Go over the directions with students. Give students time to complete the learning activity, and then go over the answers together. Ask students to share their responses to Problem 6.

Answer Key for What Would You Use?

1. centimeters
2. meters
3. meters
4. kilometers
5. millimeters
6. Accept all responses that accurately describe numerical relationships between the units. Students may also note that all of the units are used to measure length/distance.

BUILD (40 min) 

Back-to-Back, Front-To-Front (10 min)

1. Ask these questions while calling Back-to-Back and Front-to-Front. Ask additional questions if time permits.



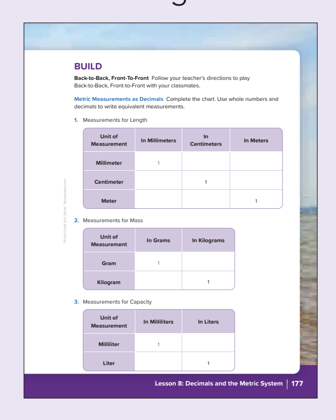
- *What is another way to write 65 millimeters?* 6 centimeters and 5 millimeters
- *What is another way to write 2,250 meters?* 2 kilometers and 250 meters
- *What is another way to write 5,700 grams?* 5 kilograms and 700 grams
- *What is another way to write 7 liters?* 7,000 milliliters
- *What is another way to write 3 kilograms?* 3,000 grams
- *What is another way to write 1,389 milliliters?* 1 liter and 389 milliliters

2. Instruct students to return to their seats. Briefly discuss the equivalent measurements described in the questions.

Metric Measurements as Decimals (15 min)

1. Explain that, like our place value system, relationships in the metric system are based on 10, 100, and 1,000, also known as powers of 10.
2. Ask students to recall how many millimeters are in a centimeter. Since there are 10 millimeters in a centimeter, a millimeter is one-tenth of a centimeter. Write 1 mm = 0.1 cm on the board.
3. Repeat with centimeters in a meter and meters in a kilometer. Write 1 cm = 0.01 m and 1 m = 0.001 km on the board.
4. Allow students time to complete the charts with a partner or in small groups. If students are struggling, complete the charts together.

Student Page 177



BUILD

Back-to-Back, Front-To-Front Follow your teacher's directions to play Back-to-Back, Front-to-Front with your classmates.

Metric Measurements as Decimals Complete the chart. Use whole numbers and decimals to write equivalent measurements.

1. Measurements for Length

Unit of Measurement	In Millimeters	In Centimeters	In Meters
Millimeter	1		
Centimeter		1	
Meter			1

2. Measurements for Mass

Unit of Measurement	In Grams	In Kilograms
Gram	1	
Kilogram		1

3. Measurements for Capacity

Unit of Measurement	In Milliliters	In Liters
Milliliter	1	
Liter		1

Lesson 8: Decimals and the Metric System | 177

Back-To-Back, Front-To-Front
Teacher Note for #1:

In Back-To-Back, Front-To-Front, students walk around the room. When Back-To-Back is called out, they must stand back-to-back with a partner, ask a question, and then say Front-to-Front. Students turn around and discuss the question with their partners. Then, instruct students to continue walking around the room.

Answer Key for Metric Measurements as Decimals

1. Measurements for Length

Unit of Measurement	In Millimeters	In Centimeters	In Meters
Millimeter	1	0.1	0.001
Centimeter	10	1	0.01
Meter	1,000	100	1

2. Measurements for Mass

Unit of Measurement	In Grams	In Kilograms
Gram	1	0.001
Kilogram	1,000	1

3. Measurements for Capacity

Unit of Measurement	In Milliliters	In Liters
Milliliter	1	0.001
Liter	1,000	1

Metric Match (15 min)

1. Explain that since metric measurements are related through powers of 10, it is possible to write measurements using decimals.
2. Revisit the questions in Back-to-Back, Front-to-Front. Point out how the decimal point shifts within the number.



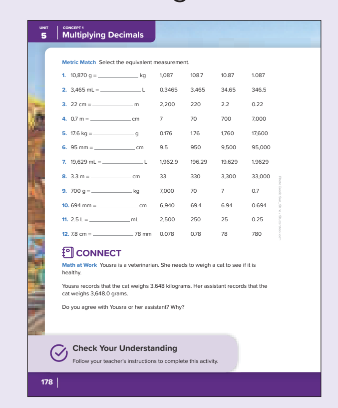
- *What is another way to write 65 millimeters? 6.5 centimeters*
- *What is another way to write 2,250 meters? 2.250 or 2.25 kilometers*
- *What is another way to write 5,700 grams? 5.700 or 5.7 kilograms*
- *What is another way to write 1,389 milliliters? 1.389 liters*

3. Ask students to complete the problems in small groups.

Answer Key for Metric Match

1. 10.87	**5.** 17,600	**9.** 0.7
2. 3.465	**6.** 9.5	**10.** 69.4
3. 0.22	**7.** 19.629	**11.** 2,500
4. 70	**8.** 330	**12.** 78

Student Page 178


UNIT 5 | CONCEPT 1
Multiplying Decimals

Metric Match Select the equivalent measurement.

1. 10,870 g = ______ kg	1,087	108.7	10.87	1.087
2. 3,465 mL = ______ L	0.3465	3.465	34.65	346.5
3. 22 cm = ______ m	2,200	220	2.2	0.22
4. 0.7 m = ______ cm	7	70	700	7,000
5. 17.6 kg = ______ g	0.176	1.76	1,760	17,600
6. 95 mm = ______ cm	9.5	950	9,500	95,000
7. 19,629 mL = ______ L	1,962.9	196.29	19.629	1.9629
8. 3.3 m = ______ cm	33	330	3,300	33,000
9. 700 g = ______ kg	7,000	70	7	0.7
10. 694 mm = ______ cm	6,940	69.4	6.94	0.694
11. 2.5 L = ______ mL	2,500	250	25	0.25
12. 7.8 cm = ______ 78 mm	0.078	0.78	78	780

Photo Credit: Sun_Shine / Shutterstock.com

CONNECT

Math at Work Yousra is a veterinarian. She needs to weigh a cat to see if it is healthy.

Yousra records that the cat weighs 3.648 kilograms. Her assistant records that the cat weighs 3,648.0 grams.

Do you agree with Yousra or her assistant? Why?

Check Your Understanding
Follow your teacher's instructions to complete this activity.

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CONNECT (7 min)



Math at Work

Ask students to read and respond to the CONNECT prompt.

Answer Key for Math at Work

Both responses are correct. The measurements are equivalent.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Ask students which way of reporting the measurement is more efficient and why.

PRACTICE

1. 600 cm; 6,000 mm; 0.006 km
2. 7.39
3. 0.062
4. 129.33
5. 28,000
6. 341.7

Challenge They are equivalent.

DIGITAL



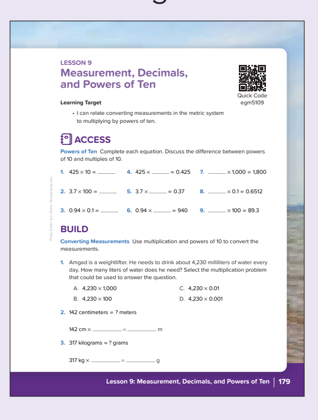
Quick Code:
egmt5109

VIDEO LESSON



Quick Code:
egmt5110

Student Page 179


LESSON 9
Measurement, Decimals, and Powers of Ten

LESSON 9
Measurement, Decimals, and Powers of Ten

Lesson Overview

In this lesson, students convert measurement units within the metric system. Unlike previous work with measurement conversions, students use what they have learned about decimal place value and multiplying by powers of 10.

Lesson Essential Question

- How are decimals used in measurement?

Lesson Learning Objective

- Students will relate converting measurements in the metric system to multiplying by powers of ten.

Grade-Level Standards

5.A.4 Use place value to read and write decimals to the Thousandths place.

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

COMMON MISCONCEPTIONS AND ERRORS

Students may have difficulty determining the powers of 10 by which to multiply depending on whether they are writing a smaller unit of measurement as a larger unit or a larger unit as a smaller unit.





Powers of Ten

Instruct students to fill in the blank to complete each equation. Review answers with the class. Remind students or discuss how multiples of 10 (10, 20, 30...) are different from powers of ten (0.001, 0.01, 0.1, 10...).

Answer Key for Powers of Ten

1. 4,250
2. 370
3. 0.094
4. 0.001
5. 0.1
6. 1,000
7. 1.8
8. 6.512
9. 0.893

BUILD (45 min) 

Converting Measurements (15 min)

1. Ask a volunteer to read aloud Problem 1. Write the four expressions on the board.
2. Ask students to talk to a Shoulder Partner to determine which problem they think they could use to answer the question.
3. Use the Four Corners strategy to discuss. Post one problem in each corner of the room or tell students which corner goes with each problem. Ask students to go to the corner with the problem they think could be used to answer the question.
4. Call on one or two students from each corner to share their thinking. When finished, allow students to move to a different corner if one of their classmates' explanations caused them to change their mind.
5. Have students return to their seats. Use a Think Aloud to model how to select the correct problem and find the solution. Example:
   - $4,230 \times 1,000$ and $4,230 \times 100$ cannot be correct because liters are larger than milliliters, so the answer should be less than 4,230.
   - Multiplying 4,230 by a decimal will result in a smaller number.
   - Since there are 1,000 milliliters in a liter, a milliliter is 0.001 L.
   - To calculate how many liters are equal to 4,230 milliliters, I have to multiply $4,230 \times 0.001$. So the answer is 4.23 L.
6. Ask students to help you solve Problem 2 using multiplication and powers of 10 to convert the measurement. Repeat the process for Problem 3.

Converting Measurements Teacher Note for #1:

Students may already know the answer from what they learned in the previous lesson. However, the goal of this lesson is to relate their prior knowledge to multiplication and powers of 10.

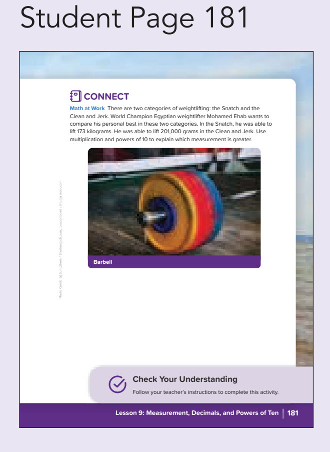
Answer Key for Converting Measurements

1. $4,320 \times 0.001$
2. 0.01; 1.42
3. 1,000; 317,000

Identify the Correct Conversion (30 min)

Go over the directions with students. Then, ask students to fill in the blanks for each problem, even if the multiplication problem is incorrect.

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Answer Key for Identify the Correct Conversion

A. Y; 7
B. N; 5.1
C. Y; 2.3
D. N; 4.8
E. Y; 1
F. Y; 0.5
G. Y; 0.04
H. N; 0.5
I. N; 567
J. N; 78.2
K. Y; 0.782
L. Y; 3.15
M. N; 150
N. Y; 64.1
P. Y; 6.41
Q. Y; 3.5
R. Y; 5,500
S. N; 32,500
T. Y; 8
U. N; 1,030
V. N; 93.2
W. Y; 93.2
X. Y; 970
Y. N; 9.7

CONNECT (5 min) 

Math at Work

Read the directions aloud and ask students to respond to the prompt.

Answer Key for Math at Work

Because $173 \times 1{,}000 = 173{,}000$, 201,000 g is greater; or 201,000 g is greater because $201{,}000 \times 0.001$ is 201.

WRAP-UP (5 min)



Let's Chat About Our Learning

Ask students to use a Fist-to-Five to evaluate their current understanding of the connection between multiplication, powers of 10, and metric measurement conversions. Ask students to share the questions they still have. Encourage students to help each other build understanding.

PRACTICE

1. 0.742
2. 10.425
3. $\times 0.01$
4. $\times 1{,}000$
5. 53.56

LESSON 10
Solving Multistep Story Problems

Lesson Overview

In this lesson, students solve multistep story problems involving addition, subtraction, and multiplication of decimals.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?
- How are decimals used in measurement?
- How are decimals used in solving real-world measurement problems involving measurement?

Lesson Learning Objective

- Students can solve multistep story problems involving addition, subtraction, and multiplication of decimals.

Grade-Level Standards

5.A.3 Perform operations with multidigit whole numbers and with decimals to Hundredths.

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.b Use unit conversions in solving multistep, real-world problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to understand story problems.
- Students may struggle to answer story problems completely if they do not have a problem-solving plan prior to answering the question.
- Students who rely on key words may misinterpret what is happening in the problem. For example, students may think that "in all" always means to add in a problem or that "how many times" always means to multiply.

DIGITAL



Quick Code: egmt5111

Materials List

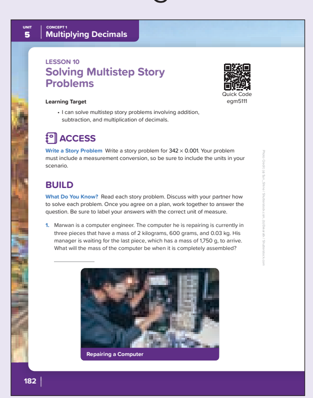
- Thinking Like a Mathematician Anchor Chart

VIDEO LESSON



Quick Code: egmt5112

Student Page 182





ACCESS (10 min)



Write a Story Problem

Go over the directions with students. Give students time to complete the learning activity. If time permits, ask students to trade story problems with a Shoulder Partner to give feedback and solve.

Answer Key for Write a Story Problem

Accept all story problems that include measurement conversions and use units in the scenario.

BUILD (40 min)



What Do You Know?

1. Ask students to discuss Problem 1 with a partner. Tell students not to solve the problem yet.
2. Discuss students' observations about the problem. Work with students to develop a problem-solving plan. Ask students to think about what they know, what they are trying to find out, and what mathematical operations might be involved. Discuss the advantages and disadvantages of converting all the measurements to grams or to kilograms. It does not make a difference whether all measurements are converted to grams or kilograms, though it makes sense to give the final answer in kilograms.
3. Model solving the problem on the board. Ask students to help provide the problem-solving steps.
4. Instruct students to work with their partner to solve Problems 2 to 5. Remind students to discuss and agree on a problem-solving plan first before solving the problem. With about 10 minutes remaining, stop to discuss the problems with the class.

Answer Key for What Do You Know?

1. 4.38 kg or 4,380 g
2. 3 packages; 2.1 m or 210 cm left over
3. 430 mL or 0.43 L
4. 11.8 cm or 0.118 m
5. Ehab grew 0.8 cm or 8 mm more than Eman.

CONNECT (7 min)

Math at Work

Read the problem aloud and ask students to solve the problem.

Answer Key for Math at Work

Explanations should include converting the measurements so that they are in the same unit and using multiplication to find the areas. The old circuit board measures 26.1 square centimeters, and the new circuit board measures 44 square centimeters.

WRAP-UP (3 min)



Let's Chat About Our Learning

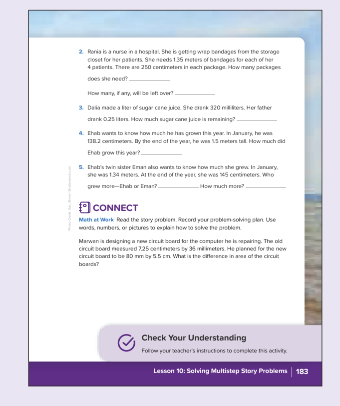
Ask students to discuss how the solution would be the same and how it would be different if they converted the measurements in CONNECT to a different unit.

If they converted to millimeters, they would be using more whole numbers, meaning the calculations would involve larger numbers. If they converted to kilograms, they would be using more decimals. No matter to what unit they convert, the difference is the same but given in different units.

PRACTICE

1. 7.65 m
2. 2,800 mL
3. 21 plants

Student Page 183



2. Rania is a nurse in a hospital. She is getting wrap bandages from the storage closet for her patients. She needs 1.35 meters of bandages for each of her 4 patients. There are 250 centimeters in each package. How many packages does she need? ______

   How many, if any, will be left over? ______

3. Dalia made a liter of sugar cane juice. She drank 320 milliliters. Her father drank 0.25 liters. How much sugar cane juice is remaining? ______

4. Ehab wants to know how much he has grown this year. In January, he was 138.2 centimeters. By the end of the year, he was 1.5 meters tall. How much did Ehab grow this year? ______

5. Ehab's twin sister Eman also wants to know how much she grew. In January, she was 1.34 meters. At the end of the year, she was 145 centimeters. Who grew more—Ehab or Eman? ______ How much more? ______

CONNECT

Math at Work Read the story problem. Record your problem-solving plan. Use words, numbers, or pictures to explain how to solve the problem.

Marwan is designing a new circuit board for the computer he is repairing. The old circuit board measured 7.25 centimeters by 36 millimeters. He planned for the new circuit board to be 80 mm by 5.5 cm. What is the difference in area of the circuit boards?

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 10: Solving Multistep Story Problems | 183

DIGITAL



Quick Code:
egmt5113

CONCEPT CHECK-IN AND REMEDIATION
Multiplying Decimals

Lesson Overview

In this concept, students work to correct misconceptions and errors related to multiplying with decimals. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?
- What is the relationship between the size of the factors and the size of the products when multiplying decimals?
- What strategies can be used to multiply and divide decimals?
- How are decimals used in measurement?
- How are decimals used in solving real-world measurement problems involving measurement?

Lesson Learning Objective

- Students will correct misconceptions and errors related to decimal multiplication.

Grade-Level Standards

5.A.3 Perform operations with multidigit whole numbers and with decimals to Hundredths.

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.A.4 Use place value to read and write decimals to the Thousandths place.

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

5.D.1.b Use unit conversions in solving multistep, real-world problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused by which direction to move the decimal point when multiplying decimal numbers.
- Students may struggle when they need to use zeros as placeholders when multiplying by powers of 10.
- Students may read the decimal 1.25 as "one point two five." Students should be corrected to read decimals properly, referencing the decimal point and place value.
- Students may be confused when a product ends in zero.
- Students may assume multiplication always produces larger numbers.
- Students may be confused when rounding down and mistakenly decrease the digit in the place to which it is being rounded instead of keeping the digit the same.
- Students may believe that the only way to estimate is by using rounding.
- Students may have difficulty decomposing a factor properly according to the value of each of its digits.
- Students may have trouble understanding that multiplying Tenths and Hundredths results in Thousandths and that multiplying Hundredths by Hundredths results in Ten-Thousandths.
- Students sometimes believe it is necessary to line up decimal points and places when setting up multiplication problems, which may cause confusion as they solve.
- Students may have difficulty determining by which powers of 10 to multiply depending on whether they are writing a smaller unit of measurement as a larger unit or a larger unit as a smaller unit.
- Students may struggle to answer story problems completely if they do not have a problem-solving plan prior to answering the question.
- Students who rely on key words may misinterpret what is happening in the problem.

Remediation: Correcting Misconceptions

If . . . Students have difficulty understanding how the size of factors affect the size of the product.	**Then . . .** Review Lesson 3 BUILD and Lesson 4 BUILD. Consider additional opportunities for hands-on practice using Base 10 grids. Provide more practice using estimation to predict where the decimal will be placed.
If . . . Students have difficulty multiplying using the standard algorithm.	**Then . . .** Review Lesson 7 BUILD. Ask students to solve a problem using an area model and then model solving with the standard algorithm. Make connections and explicitly connect the steps of both models.
If . . . Students struggle to determine by which powers of 10 to multiply when converting measurements.	**Then . . .** Review Lesson 9 BUILD. Provide additional support forming comparison statements. For example, when converting from centimeters to another unit of length, think 1 cm is (by which powers of 10 to multiply) _______ new unit.





CONCEPT
2

Dividing Decimals

Concept Overview

In Concept 2 Strategies for Dividing Decimals, students learn about division with decimals. Students begin to develop their understanding by identifying patterns when dividing by powers of 10 and modeling problems using Base 10 blocks. Students use a variety of strategies to estimate quotients to build their number sense and support them in accurately solving division problems with decimals in the following lessons. Students then explore representing quotients as decimals rather than with remainders when dividing whole numbers by whole numbers. This understanding leads students into dividing decimals by whole numbers and decimals by decimals and helps students to properly place decimal points in quotients. Students conclude the concept by utilizing their knowledge of all four decimal operations to solve multistep problems including measurement.

Concept Standards

5.A.3 Perform operations with multidigit whole numbers and with decimals to Hundredths.

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

5.D.1.b Use unit conversions in solving multistep, real-world problems.

LESSON 11
Dividing by Powers of Ten

Lesson Overview

In this lesson, students practice identifying patterns when dividing by whole number powers of 10 and decimal powers of 10. They build on prior learning about whole number division and use familiar strategies to build fluency. This deepens students' understanding of connections across mathematical concepts and empowers them to work with large whole numbers and small decimal numbers.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?

Lesson Learning Objective

- Students will explain patterns they observe when dividing by powers of ten.

Grade-Level Standards

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

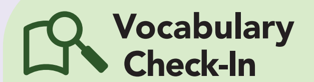
COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused by which direction to move the decimal point when dividing decimals.
- Students may assume division will always result in a smaller quotient. However, dividing by a decimal may actually result in a larger quotient.
- Students may struggle when they need to use zeros as placeholders in a number when dividing by powers of 10. For example, $30 \div 10 = 3$, but $30 \div 1{,}000 = 0.03$ and not 00.3.

DIGITAL



Quick Code: egmt5114



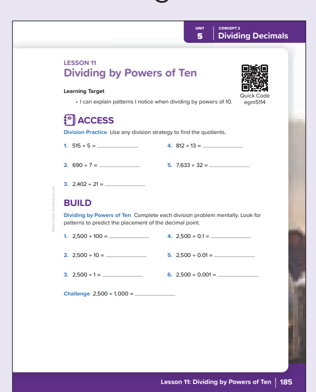
inverse operations, powers of ten

VIDEO LESSON



Quick Code: egmt5115

Student Page 185






Division Practice

Instruct students to complete the division problems using any strategy they know. Ask students to reflect on what they notice when dividing with whole numbers. Make sure that students recognize that all of the quotients are smaller than the dividend and that some problems have remainders.

Answer Key for Division Practice

1. 103
2. 98 R4
3. 114 R8
4. 62 R6
5. 238 R17

BUILD (45 min)



Dividing by Powers of Ten (20 min)

1. Remind students that the powers of 10 include whole numbers, such as $10 = 10 \times 1$, $100 = 10 \times 10$, and $1{,}000 = 10 \times 10 \times 10$, and decimals, such as $0.1 = 1 \div 10$, $0.01 = 1 \div (10 \times 10)$; and $0.001 = 1 \div (10 \times 10 \times 10)$.
2. Write $3{,}100 \div 100 =$ _____ on the board. Ask students to discuss with a partner how they would solve this problem. Encourage students to use what they learned about multiplying by powers of 10 in their reasoning. Call on two or three students to share their thinking and their answers. Write the correct answer on the board. $3{,}100 \div 100 = 31$
3. Write $3{,}100 \div 10 =$ _____ on the board. Ask students what is different about this problem and how they think it will change the quotient. Write the answer on the board. $3{,}100 \div 10 = 310$
4. Write the following problems on the board. Ask students to share what they notice and to make predictions about the quotients.

   $3{,}100 \div 0.1 =$ _____

   $3{,}100 \div 0.01 =$ _____

   $3{,}100 \div 0.001 =$ _____
5. Record the answers on the board. 31,000; 310,000; 3,100,000
6. Ask students to describe what they notice happening in these problems. As the divisor decreases by a power of 10, the quotient increases by a power of 10. Explain that, when the divisor is a whole number, the decimal point in the quotient shifts to the left once for each zero. However, when the divisor is a decimal, it shifts to the right once for each decimal place.

7. Ask students to apply what they have learned to Problems 1 to 6. Go over the answers together. If time permits, show how multiplication can be used to check the quotients.

8. Ask students to explain in their own words the patterns they have observed as they solved the problems. Ask students to explain how the decimal point moves when dividing by decimal powers of 10. The decimal point shifts to the right when dividing by decimal powers of 10.

Answer Key for Dividing by Powers of Ten

1. 25
2. 250
3. 2,500
4. 25,000
5. 250,000
6. 2,500,000

Challenge 2.5

Fill It In (25 min)

Instruct students to use the patterns they have just discovered to solve the problems. If students are struggling, consider working through some of the problems together or working with a small group.

Answer Key for Fill It In

1. 8; 80; 800; 8,000; 80,000
2. 6.7; 67; 670; 6,700; 67,000; 670,000
3. 3.2
4. 57
5. 0.057
6. 216
7. 0.071
8. 1,280
9. 0.04
10. 400
11. 290.8
12. 10,230



CONNECT (7 min)



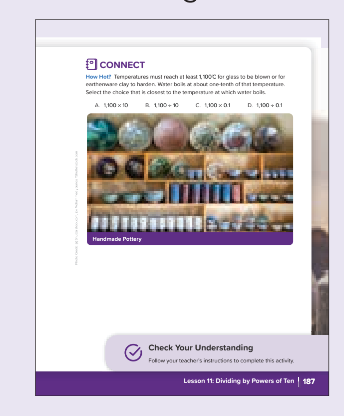
How Hot?

Read the problem with students and ask them to respond to the prompt.

Answer Key for How Hot?

B or C

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How Hot?
Teacher Note:

It is acceptable if students only select one of the correct problems. Students will further explore relationships between multiplying and dividing by powers of 10 in the next lesson.

WRAP-UP (3 min)



Let's Chat About Our Learning

Call on volunteers to share their thinking about the CONNECT question. Encourage students to ask each other questions and to help clear up misconceptions.

PRACTICE

1. 51.7; 5,170; 51,700; 517,000
2. 3.036; 30.36; 3,036; 30,360
3. 0.92
4. 8.8
5. 3,100

LESSON 12
Patterns and Relationships in Powers of Ten

Lesson Overview

In this lesson, students explore multiplication and division problems that have the same answer. They examine the problems to identify relationships among whole number and decimal powers of 10.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?
- How are decimals used in measurement?

Lesson Learning Objective

- Students will make connections between multiplying and dividing by powers of ten.

Grade-Level Standards

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

COMMON MISCONCEPTIONS AND ERRORS

Students may have difficulty understanding that when multiplying and dividing by whole number and decimal powers of 10, problems with inverse operations can have the same answer.

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Quick Code: egmt5116

Materials List

- Index cards, 15

Preparation

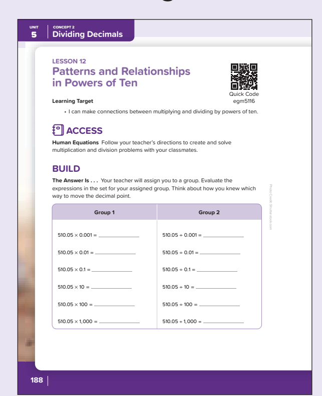
- Write the following on the cards: digits 1 to 9, a decimal point, and 5 zeros.

VIDEO LESSON



Quick Code: egmt5117

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ACCESS (10 min)

Human Equations

1. Invite five students to the front of the room. Give four students a digit card. Give the fifth student a decimal point and ask students to create a number. The decimal point may be anywhere in the number.
2. Ask students to multiply or divide the number by a power of 10. Ask the students to help the student holding the decimal point move to the left or the right into the correct spot to show the answer. Additional students may need to join the group as zeros. Repeat with different students and different decimals until time is up.

BUILD (40 min)



The Answer Is . . . (10 min)

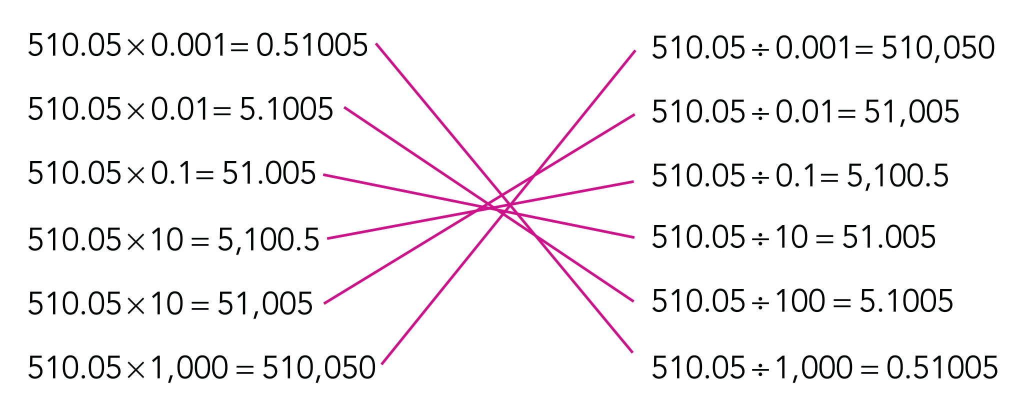
1. Count off students, assigning each a 1 or a 2. Ask students in Group 1 to complete the multiplication problems. Ask students in Group 2 to complete the division problems. Encourage students in each group to work together to solve the problems.
2. Assign students into groups of four. If possible, each group should include two Group 1 students and two Group 2 students (or at least a mix of the two groups).
3. Ask students to share their answers with their group and to discuss the following questions:



- *What do you notice about your answers?*
- *How did the decimal point move in the multiplication problems? How did the decimal point move in the division problems?*
- *What do you notice about the number of zeros or the number of decimal places?*
- *When is your answer largest? When is your answer smallest?*

4. After groups have discussed, invite students to share their observations with the class. Be sure to highlight the following:
   - The movement of the decimal point and the relative size of the answer when multiplying or dividing by a whole number power of 10.
   - The movement of the decimal point and the relative size of the answer when multiplying or dividing by a decimal number power of 10.
   - Multiplication and division problems can have the same answer.
5. Ask students to draw lines between problems with the same answer.

Answer Key for The Answer Is . . .



Same Answer, Inverse Operation (15 min)

Ask students to complete Problems 1 to 8. Go over the answers together. Ask students to describe what they notice about the powers of 10 used in each pair of problems. The powers of 10 are opposites (for example Tens and Tenths).

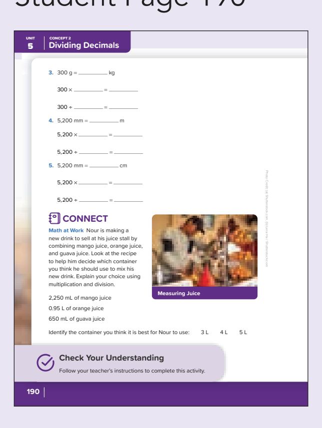
Answer Key for Same Answer, Inverse Operation

1. 10; 0.1
2. 0.01; 100
3. 100; 0.01
4. 100; 0.01
5. 0.1; 10
6. 1,000; 0.001
7. 0.01; 100
8. 1,000; 0.001

Metric Conversions with Multiplication and Division (15 min)

1. Remind students that multiplying by powers of 10 is a method used to convert metric measurements. Write 357 cm = _____ m on the board.
2. Ask students to complete the conversion. Then, ask students how to use multiplication to convert the measurement to meters and record the equations on the board. 1 cm is 0.01 of a meter, $357 \times 0.01 = 3.57$
3. Ask students how to rewrite this equation using division so that it has the same answer. Record the answer on the board. $357 \div 100 = 3.57$
4. Ask students why dividing by 100 and multiplying by 0.01 gives the same answer. When you divide by 100, the decimal point moves two places to the left. When you multiply by 0.01, the decimal point also moves two places to the left.
5. Ask students to work with a partner to complete Problems 1 to 5.

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Answer Key for Metric Conversions with Multiplication and Division

1. 0.712; $712 \times 0.001 = 0.712$; $712 \div 1{,}000 = 0.712$
2. 2,300; $23 \times 100 = 2{,}300$; $23 \div 0.01 = 2{,}300$
3. 0.3; $300 \times 0.001 = 0.3$; $300 \div 1{,}000 = 0.3$
4. 5.2; $5{,}200 \times 0.001 = 5.2$; $5{,}200 \div 1{,}000 = 5.2$
5. 520; $5{,}200 \times 0.1 = 520$; $5{,}200 \div 10 = 520$


CONNECT (7 min)



Math at Work

Read the problem with students. Direct students to respond to the prompt.

Answer Key for Math at Work

Answers may vary between 4 L or 5 L. Possible explanations: To convert 0.95 L to mL, multiply by 1,000 (950 mL). $2{,}250 + 950 + 650 = 3{,}850$ mL. To convert 3,850 mL to L, divide by 1,000 (3.85 L). The mixture will fit into the 4 L container; the 5 L container will give him more room to stir his juice or make it easier to pour.

WRAP-UP (3 min)



Let's Chat About Our Learning

Invite students to share their responses to the CONNECT problem. Since two answers are possible, encourage students to explain their reasoning.

PRACTICE

1. 0.1
2. 10
3. 0.045; 1,000; 0.045
4. 8.377; 10; 8.377
5. 624; 0.01; 624

LESSON 13
Modeling Decimal Division

Lesson Overview
In this lesson, students practice determining the meaning of a division story problem. They use Base 10 blocks to model decimal division and expand their understanding of the process.

Lesson Essential Questions
- How does understanding place value help us multiply and divide decimals efficiently?
- What is the meaning of division with decimals?
- What is the relationship between the size of the quotient and the size of the divisor when dividing decimals?

Lesson Learning Objectives
- Students will explain the meaning of decimal division problems.
- Students will use models to represent decimal division.

Grade-Level Standard
5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not be used to the divisor being greater than the dividend, resulting in a quotient less than 1.
- Students may flip the divisor and dividend when the divisor is greater to make the problem seem more familiar to them. For example, given the expression $2.7 \div 9$, students may try to rewrite this as $9 \div 2.7$. However, this problem does not have the same meaning or the same answer.

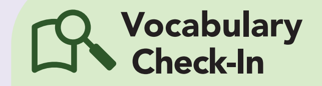
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Quick Code: egmt5118

Materials List

- Base 10 blocks (from Lesson 2)



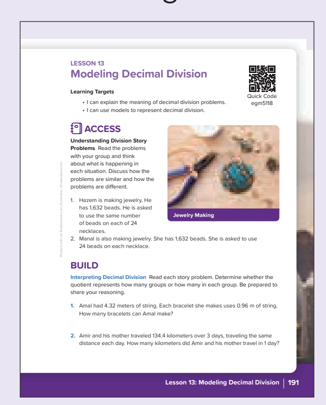
dividend, divisor, quotient

VIDEO LESSON



Quick Code: egmt5119

Student Page 191


LESSON 13

Modeling Decimal Division

Quick Code egm5118

Learning Targets

- I can explain the meaning of decimal division problems.
- I can use models to represent decimal division.

ACCESS

Understanding Division Story Problems Read the problems with your group and think about what is happening in each situation. Discuss how the problems are similar and how the problems are different.

1. Hazem is making jewelry. He has 1,632 beads. He is asked to use the same number of beads on each of 24 necklaces.
2. Manal is also making jewelry. She has 1,632 beads. She is asked to use 24 beads on each necklace.

Jewelry Making

BUILD

Interpreting Decimal Division Read each story problem. Determine whether the quotient represents how many groups or how many in each group. Be prepared to share your reasoning.

1. Amal had 4.32 meters of string. Each bracelet she makes uses 0.96 m of string. How many bracelets can Amal make?
2. Amir and his mother traveled 134.4 kilometers over 3 days, traveling the same distance each day. How many kilometers did Amir and his mother travel in 1 day?

Lesson 13: Modeling Decimal Division | 191



ACCESS (10 min)

Understanding Division Story Problems

1. Divide students into groups of three or four. Ask students to read and discuss both story problems.
2. After students have share their thinking in their small groups, ask them to explain how the problems are alike and different. Both problems can be solved using 1, 1,632 ÷ 24. In Problem 1, students are trying to figure out how many are in each group. In Problem 2, students are trying to figure out how many groups there are.
3. Ask students to identify the questions that they think each problem is asking. Problem 1 is asking how many beads will be on each necklace. Problem 2 is asking how many necklaces Manal can make.
4. Write the problems on the board in standard algorithm format. Ask students to provide the steps to solve the problems. Discuss what the answer means in the context of each problem.

Answer Key for Understanding Division Story Problems

1. Each necklace will have 68 beads.
2. She can make 68 necklaces.

BUILD (40 min)



Interpreting Decimal Division (20 min)

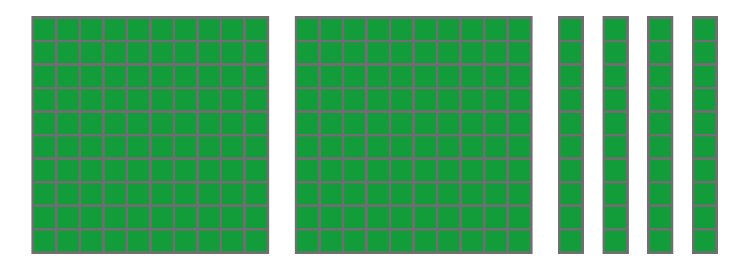
1. Remind students that division can be used to find how many groups or how many in each group.
2. Work with students to read Problem 1. Ask students to discuss the meaning of the problem and what the divisor and the quotient represent. Since the divisor is a decimal, it represents how many in each group. The quotient will represent how many groups of 0.96 can be formed.
3. Repeat the process with Problem 2. Since the divisor is a whole number, it represents how many groups. The quotient will represent how many will be in each of the 3 groups.
4. Divide students into pairs or small groups. Ask students to sort Problems 3 to 7.

Answer Key for Interpreting Decimal Division

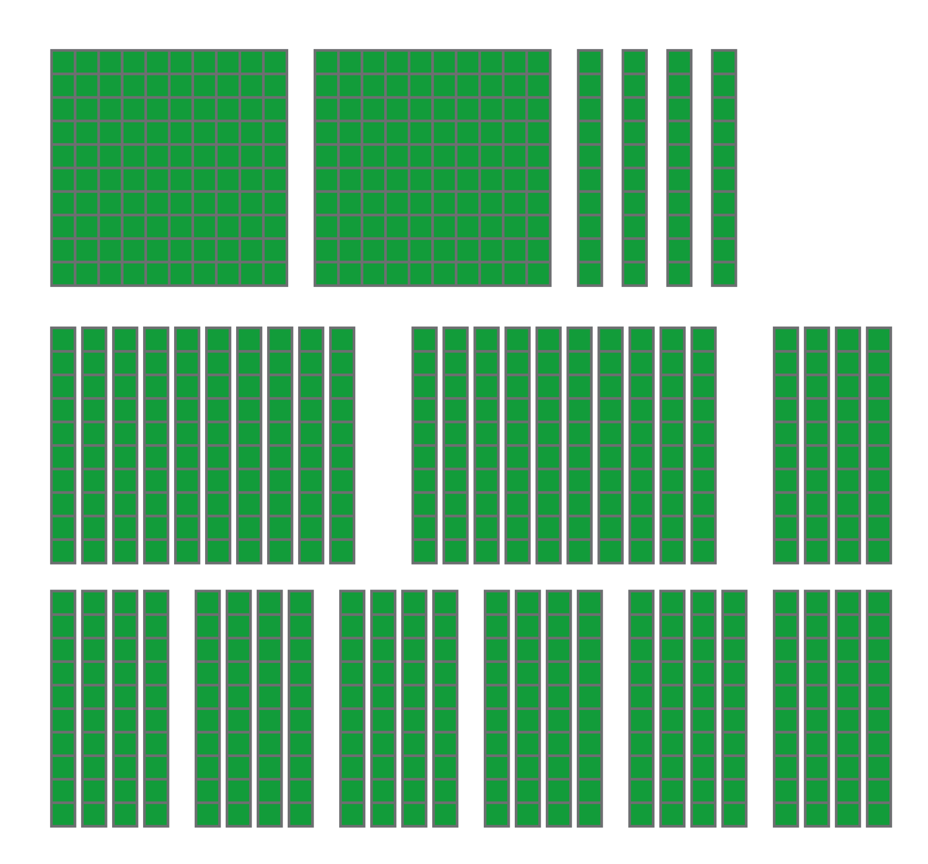
1. how many groups
2. how many in each group
3. how many in each group
4. how many in each group
5. how many groups
6. how many groups
7. how many in each group

Modeling Decimal Division (20 min)

1. Give each pair of students a set of Base 10 blocks. Tell students that they will be using the blocks to model decimal division. The flat will represent 1 whole. Ask students what each rod represents 1 Tenth and what each small cube represents. 1 Hundredth
2. Ask students to work with their partner to represent the number 2.4 using their Base 10 blocks.



3. Write Problem 1 on the board. Ask students to explain the meaning of the problem. How many groups of 0.4 are in 2.4
4. Model solving this problem using a Think Aloud as students follow along. An example follows:
   - This problem is asking how many groups of 0.4 are in 2.4.
   - 0.4 is 4 of the rods. How many groups of 4 rods are there in 2.4?
   - Each flat is equal to 10 rods. I can exchange the two flats for rods so they can be separated into groups of 4 rods.
   - There are 6 groups of 4 rods, so there are 6 groups of 0.4 in 2.4.
5. Write $2.4 \div 0.4 = 6$ on the board. Point out that the quotient is larger than the dividend. Explain that this occurred because the divisor is a decimal number less than 1.



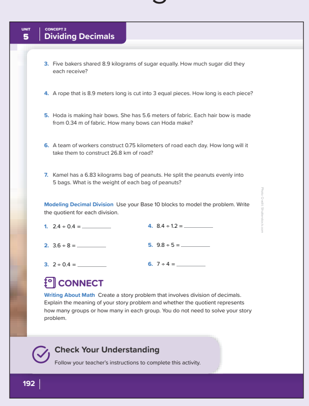
6. Repeat the process for Problem 2. Regroup flats and rods as needed.

7. Ask students to work with their partners to complete Problems 3 to 6. Go over the answers together.

Answer Key for Modeling Decimal Division

1. 6
2. 0.45
3. 5
4. 7
5. 1.96
6. 1.75





CONNECT (7 min)

Writing About Math

Read the prompt aloud and ask students to create a story problem that involves division of decimals.

Answer Key for Writing About Math

Accept all appropriate story problems and explanations.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to exchange their story problems from CONNECT with their Shoulder Partner. Students should identify the meaning of their partner's problem and explain what the divisor and quotient represent.

Writing About Math Teacher Note:

Students do not need to solve the story problems at this time. They should be focused on understanding the meaning of the problem and whether the quotient will represent how many groups or how many in each group.

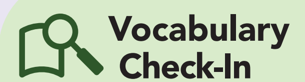
PRACTICE

1. how many groups
2. how many in each group
3. 0.2
4. 4
5. 1.36

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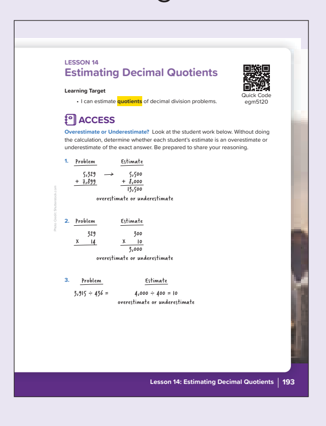
compatible numbers,
overestimate,
underestimate

VIDEO LESSON



Quick Code:
egmt5121

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LESSON 14
Estimating Decimal Quotients

Quick Code
egm5120

Learning Target

- I can estimate **quotients** of decimal division problems.

ACCESS

Overestimate or Underestimate? Look at the student work below. Without doing the calculation, determine whether each student's estimate is an overestimate or underestimate of the exact answer. Be prepared to share your reasoning.

1. Problem: 5,329 + 7,899 → Estimate: 5,500 + 8,000 = 13,500
overestimate or underestimate

2. Problem: 329 x 14 → Estimate: 300 x 10 = 3,000
overestimate or underestimate

3. Problem: 3,915 ÷ 436 = → Estimate: 4,000 ÷ 400 = 10
overestimate or underestimate

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Lesson 14: Estimating Decimal Quotients | 193

LESSON 14
Estimating Decimal Quotients

Lesson Overview

In this lesson, students estimate quotients using rounding and compatible numbers. Estimating quotients helps students check their work and determine whether their answer is reasonable.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- What is the meaning of division with decimals?
- What is the relationship between the size of the factors and the size of the product when multiplying decimals?

Lesson Learning Objective

- Students will estimate quotients of decimal division problems.

Grade-Level Standards

5.A.4.c Use place value understanding to round decimals up to the Thousandths place.

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

COMMON MISCONCEPTIONS AND ERRORS

Students may round both the divisor and the dividend to the nearest whole number. This does not always provide a quick mental calculation for estimating the quotient.



ACCESS (10 min)



Overestimate or Underestimate?

1. Ask students to discuss why estimation is important in mathematics. Call on a few students to share their thinking with the class. Highlight responses that include that an estimate is an approximation or an answer that is close to the exact answer, that estimates are used with all types of computation problems, and that estimates are useful when an exact answer is not needed or to see if an answer seems reasonable.

2. Ask students to explain the terms overestimate and underestimate. Explain that there are some situations where it is helpful to overestimate or underestimate. For each problem, ask students to look at the estimate and to determine if it is an overestimate or underestimate.

3. Go over the answers together. If time allows, ask students to explain how they determined their answers.

Answer Key for Overestimate or Underestimate?

1. overestimate
2. underestimate
3. overestimate

BUILD (40 min) 

Estimating Decimal Quotients (15 min)

1. Write $22.3 \div 6 =$ _____ on the board. Remind students of the different meanings of division problems. One way to think about this problem is to think about dividing 22.3 into 6 groups. Ask students to make an estimate of the quotient but not to say it out loud.

2. Explain that since the divisor is a whole number, it is not necessary to change it because whole numbers are familiar and easy to work with.

3. Ask students to look at the dividend. Ask students to think of a number that is compatible with 6 and close to 22.3. 24

4. Write $24 \div 6 = 4$. Ask students if this estimate is greater than or less that the actual and why. It is an overestimate because the dividend was increased.

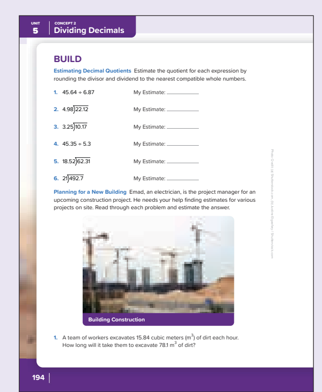
5. Ask students to look at Problem 1 and discuss strategies for estimating the quotient. Round the divisor to the nearest whole number and use a compatible number that is close to the dividend.

6. Ask students to round 6.87 to the nearest whole number. 7 Then, ask students to identify a compatible number close to the dividend. 42 or 49 Next, ask students to discuss how both numbers could be used to estimate and what impact each number would have on the estimate. If 42 is used, then the estimate will be an underestimate. If 49 is used, the estimate will be an overestimate.

7. Explain to students that because 45.64 is between 42 and 49, the exact answer will be between 6 ($42 \div 7$) and 7 ($49 \div 7$).

8. Ask students to complete the remaining problems and to compare their estimates with a partner.

Student Page 194



Estimating Decimal Quotients
Teacher Note for #1:

Another possible interpretation of this problem is how many groups of 6 are in 22.3, but this interpretation is usually more difficult for students of this age to understand conceptually.

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Answer Key for Estimating Decimal Quotients

Answers may vary but should be close to the answers below.

1. 6 or 7
2. 4 or 5
3. 3 or 4
4. 9
5. 3 or 4
6. 24 or 25

Planning for a New Building (25 min)

Read the assignment prompt aloud. Then, assign students to groups of three to complete the learning activity. Caution students to choose the operation carefully.

Answer Key for Planning For a New Building

1. 4 or 5 hr
2. 75 or 80 t
3. 11 or 12 floors
4. 2,000 or 2,246 kg
5. 70 or 80 m
6. 9 or 10 windows



CONNECT (7 min)



Writing About Math

Read the prompt to students and give them time to complete their responses. Encourage students to use mathematical vocabulary in their explanations.

Answer Key for Writing About Math

Answers will vary. Accept all answers that adequately explain students' learning.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT questions. Clear up any lingering misconceptions, is possible.

PRACTICE

1. 7
2. 13
3. 3
4. B
5. B

LESSON 15
Dividing Decimals by Whole Numbers

Lesson Overview

In this lesson, students use the standard division algorithm to divide decimals to the Thousandths place by whole numbers.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?

Lesson Learning Objectives

- Students will use the standard algorithm to divide decimals through the Thousandths place.
- Students will use estimation to check the reasonableness of their answer.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

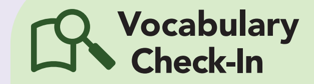
COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes make the remainder the decimal. For example, $16 \div 5 = 3$ R1 or 3.2, not 3.1.
- Students sometimes have difficulty understanding that placing a decimal and a zero to the right of the Ones place in the dividend does not change its value. For example, $156 = 156.0$ and also 156.00.
- Students might misplace the decimal point in the quotient in relation to the decimal point in the dividend, resulting in digits in the quotient with the incorrect value.

DIGITAL



Quick Code: egmt5122



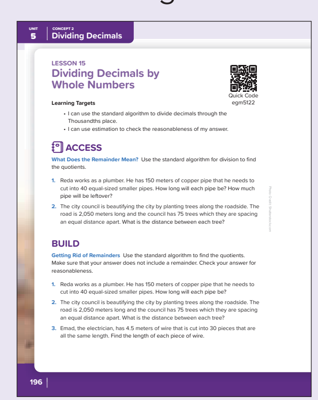
repeating decimal, terminating decimal

VIDEO LESSON



Quick Code: egmt5123

Student Page 196


UNIT 5 | CONCEPT 2 Dividing Decimals

LESSON 15
Dividing Decimals by Whole Numbers

Quick Code egm5122

Learning Targets
- I can use the standard algorithm to divide decimals through the Thousandths place.
- I can use estimation to check the reasonableness of my answer.

ACCESS

What Does the Remainder Mean? Use the standard algorithm for division to find the quotients.

1. Reda works as a plumber. He has 150 meters of copper pipe that he needs to cut into 40 equal-sized smaller pipes. How long will each pipe be? How much pipe will be leftover?
2. The city council is beautifying the city by planting trees along the roadside. The road is 2,050 meters long and the council has 75 trees which they are spacing an equal distance apart. What is the distance between each tree?

Photo Credit: Shutterstock.com

BUILD

Getting Rid of Remainders Use the standard algorithm to find the quotients. Make sure that your answer does not include a remainder. Check your answer for reasonableness.

1. Reda works as a plumber. He has 150 meters of copper pipe that he needs to cut into 40 equal-sized smaller pipes. How long will each pipe be?
2. The city council is beautifying the city by planting trees along the roadside. The road is 2,050 meters long and the council has 75 trees which they are spacing an equal distance apart. What is the distance between each tree?
3. Emad, the electrician, has 4.5 meters of wire that is cut into 30 pieces that are all the same length. Find the length of each piece of wire.

196



ACCESS (5 min)



What Does the Remainder Mean?

1. Instruct students to use the standard algorithm to solve the problems. Choose two students to solve the problems on the board. If students struggle, solve the problems on the board together.
2. Suggest to the class that 30 meters of pipe is a lot to have left over. Show with multiplication that Reda does not have enough copper pipe to cut forty 4-m pipes. Explain that a number between 3 and 4 would be more efficient so that he has less pipe leftover. Show this with multiplication: $3.5 \times 40 = 140$. Suggest that there could be a decimal number that would give an exact amount with no remainder.
3. Prompt the class to think about Problem 2 and ask for ideas on what to do with the remaining 25 m. Inform students that they will think about other ways to represent remainders in today's lesson.

Answer Key for What Does the Remainder Mean?

1. Reda will have 40 pieces of pipe measuring 3 m long and 30 m of pipe remaining.
2. The city council will plant the trees 27 m apart and have 25 remaining meters.

BUILD (45 min)



Getting Rid of Remainders

1. Rewrite and evaluate $150 \div 40$ on the board using the standard algorithm. Place a decimal point to the right of the Ones place in the dividend and place a zero in the Tenths place (150.0). Confirm with the students that the value of 150 has not changed.
2. Place a decimal point in the quotient and emphasize that the decimal point in the quotient is directly above the decimal point in the dividend between the Ones and Tenths places. Bring down the zero.
3. Explain that 30 Ones were not enough to be divided equally into 40 groups. Instead of leaving 30 Ones as the remainder, 30 Ones were regrouped into 300 Tenths. 300 Tenths is the same as 30 Ones.
4. Model using a Think Aloud and continue to divide. Think $300 \div 40$. Write 7 in the quotient. $7 \text{ (tenths)} \times 40 = 280 \text{ (tenths)}$. Subtract from 300, and the difference is 20.
5. Confirm with the students that placing a 0 in the Hundredths place will not change the value of the dividend. Then, bring down the zero. Explain that, by bringing down the zero, the 20 Tenths left over were regrouped into 200 Hundredths.

6. Write $200 \div 40 = 5$. Write 5 in the Hundredths place in the quotient. There is nothing left over and nothing else to bring down, so the problem is complete.
7. Explain that the quotient means that Reda can cut the copper pipe into forty smaller pipes, each measuring 3.75 meters. All of the pipes are equal in length and nothing is leftover. Model how to check for reasonableness with compatible numbers: $160 \div 40 = 4$ and 3.75 is close to 4. Ask students to check this with multiplication: $3.75 \times 40 = 150.00$.
8. Work with students to solve Problem 2, asking them to provide the steps you should take. Remind students that placing a decimal point to the right of the Ones place and putting a zero in the Tenths place would help the council to find the exact distance to space the trees so there is no space remaining.
9. After students have divided through the Hundredths place, ask them to describe what they notice. The difference will always be 25. The quotient of this problem is a repeating decimal.
10. Explain that the quotient means that the council should plant the trees 27.33 meters apart to have all 75 trees equally spaced with no space left over. Model how to check for reasonableness with compatible numbers: $2{,}100 \div 70 = 30$ and 27.33 is close to 30.
11. Ask students to consider when would it be useful in life to divide to the nearest Tenth or Hundredth and when it would be best to leave the remainder as a whole number. When dividing living things, it is best to leave the remainder. When using units of measure such as meters, grams, and liters, it is more accurate to continue dividing to get rid of the decimal, if possible.
12. Ask students to discuss whether it is possible to combine remainders and decimals. No, because remainders are whole numbers.
13. Ask students to complete the remaining problems independently or with a partner. Encourage students to estimate to check the reasonableness of their answers. Allow time to go over the answers together.

Answer Key for Getting Rid of Remainders

1. 3.75 m
2. 27.33 m (repeating decimal)
3. 0.15 m
4. 13.45 (repeating decimal)
5. 10.33
6. 3.89
7. 12.17
8. 19.65

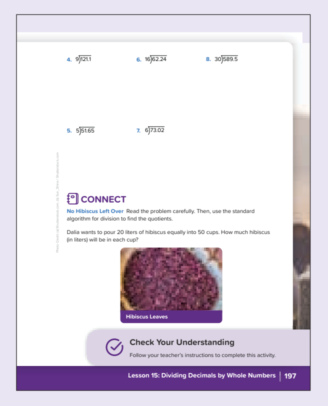
Getting Rid of Remainders
Teacher Note for #9:

Some decimals repeat, some decimals terminate (as in the previous problem), and some decimals will be irrational, meaning that they never repeat or terminate.

Getting Rid of Remainders
Teacher Note for #13:

Typically, students are accustomed to the dividend being the larger number in a division problem. Now that they are dividing with decimals, this is not always the case. They can now find quotients that are less than 1, as in Problem 3.

Student Page 197



CONNECT (7 min)

No Tea Left Over

Read the problem with students and ask them to use the standard algorithm to solve the problem.

Answer Key for No Tea Left Over

0.4 L

WRAP-UP (3 min)



Let's Chat About Our Learning

Lead a class discussion on the Essential Question: *What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?*

Accept all reasonable responses. Examples include: When there is a decimal in the dividend, there will be a decimal in the quotient. Estimating first helps place the decimal. Using powers of 10 as compatible numbers can help determine which way to shift the decimal point. When an exact answer is needed in division, a decimal point and a zero can be placed to the right of the Ones place in the dividend and directly above in the quotient.

PRACTICE

1. 0.012
2. 3.05
3. 20.5
4. 17.08
5. 223.225

LESSON 16
Dividing Decimals by Decimals

Lesson Overview

In this lesson, students use the standard algorithm to divide decimals by decimals. Students continue to work to build conceptual understanding of decimal division to support understanding of the standard algorithm.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?

Lesson Learning Objectives

- Students will use the standard algorithm to divide decimals through the Thousandths place.
- Students will use estimation to check the reasonableness of their answers.

Grade-Level Standard

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

COMMON MISCONCEPTIONS AND ERRORS

Students sometimes multiply either the divisor or the dividend by a power of 10 or multiply the divisor and the dividend by different powers of 10.



ACCESS (10 min)



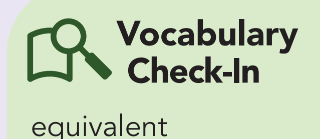
Missing Numbers

1. Instruct students to fill in the blanks to complete each equation. Go over the answers together. Ask students to describe the pattern they observed in the first six problems. When both the dividend and the divisor were multiplied by the same power of 10, the quotient stayed the same.
2. Ask students what pattern was observed in the remaining six problems. Multiplying by the opposite power of 10 (Tenths times Tens; Hundredths times Hundreds) changes a decimal to a whole number.

DIGITAL



Quick Code: egmt5124



Vocabulary Check-In

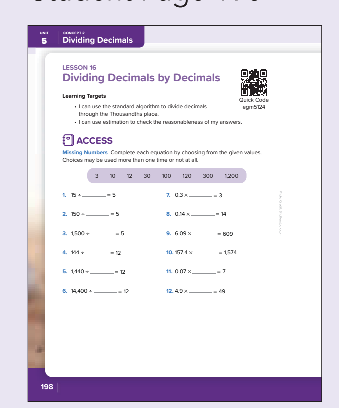
equivalent

VIDEO LESSON



Quick Code: egmt5125

Student Page 198

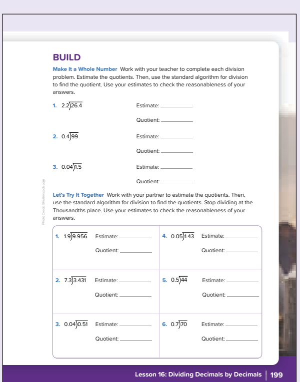


3. Explain that these are both important concepts when dividing decimals by decimals. Inform students they will practice changing the divisor to a whole number and then multiply the dividend by the same power of 10 to create an expression with the same quotient.

Answer Key for Missing Numbers

1. 3
2. 30
3. 300
4. 12
5. 120
6. 1,200
7. 10
8. 100
9. 100
10. 10
11. 100
12. 10

Student Page 199



BUILD (40 min)



Make It a Whole Number (20 min)

1. Write Problem 1 in standard algorithm format on the board. Ask students to identify compatible numbers for both factors and estimate the quotient. $26 \div 2 = 13$
2. Ask students to identify the divisor. 2.2 Ask which power of 10 to multiply by 2.2 so that the product is a whole number. 10 Tell students that, since the divisor was multiplied by 10, the dividend has to be multiplied by 10. This ensures that the quotient will be equivalent to the original problem's quotient.
3. Write the new problem, $264 \div 22$, on the board. Solve using the standard algorithm for division. The quotient is 12, which is close to the estimate of 13.
4. Repeat with Problem 2. Ask students to explain how to proceed when the difference is smaller than the divisor. A decimal point can be placed to the right of the dividend and a zero can be written in the Tenths place without changing its value.
5. Repeat the process for Problem 3.

Make It a Whole Number
Teacher Note for #3:

Emphasize that there will now be a decimal point in the quotient directly above the decimal point in the dividend. Bring down the zero and continue dividing. This represents 2 Ones being regrouped as 20 Tenths. Be sure students compare the quotient to the estimate.

Answer Key for Make It a Whole Number

1. 12
2. 247.5
3. 37.5

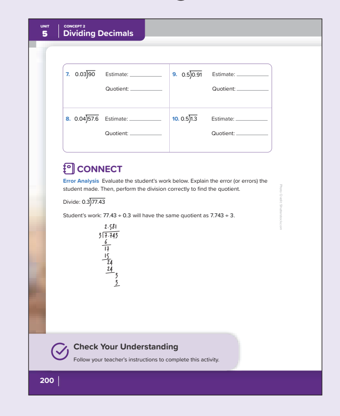
Let's Try It Together (20 min)

Assign students to a partner. Ask students to work with their partners to complete the learning activity. Go over the answers together.

Answer Key for Let's Try It Together

1. 5.24
2. 0.47
3. 12.75
4. 28.6
5. 88
6. 100
7. 3,000
8. 1,440
9. 1.82
10. 2.6

Student Page 200





CONNECT (7 min)



Error Analysis

Ask students to complete the error analysis and try to solve the problem.

Answer Key for Error Analysis

The person solving the problem changed the divisor to a whole number by multiplying it by 10 ($0.3 \times 10 = 3$). Instead of multiplying the dividend by 10, the person divided by 10 (or got confused and moved the decimal point the wrong way). $77.43 \div 0.3$ will have the same quotient as $774.3 \div 3$. The correct answer is 258.1.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to discuss the differences between dividing by a whole number and dividing by a decimal.

When dividing by a whole number, divide as usual and place the decimal point in the quotient directly above the decimal point in the dividend. When dividing by a decimal, the divisor and the dividend must by multiplied by a power of 10 so that the divisor is a whole number before dividing as usual.

PRACTICE

1. 1,120
2. 12.5
3. 126
4. 4
5. 106.55

DIGITAL



Quick Code: egmt5126

Materials List

- Crayons or markers
- Paper for posters
- Thinking Like a Mathematician Anchor Chart

VIDEO LESSON



Quick Code: egmt5127

LESSON 17
Solving Challenging Multistep Story Problems

Lesson Overview

In this lesson, students solve multistep story problems involving all four operations and decimals. Students are expected to apply all of the skills, concepts, and strategies they learned previously and in Unit 5.

Lesson Essential Questions

- How does understanding place value help us multiply and divide decimals efficiently?
- What strategies can be used to multiply and divide decimals?
- How are decimals used in measurement?
- How are decimals used in solving real-world measurement problems involving measurement?

Lesson Learning Objective

- Students will solve multistep story problems involving addition, subtraction, multiplication, and division of decimals.

Grade-Level Standards

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.b Use unit conversions in solving multistep, real-world problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to understand story problems or to answer them thoroughly if they do not have a problem-solving plan prior to answering the question.
- Students may be confused by how to treat the decimal point in decimal division problems. The divisor must be made into a whole number when dividing.

ACCESS (10 min)

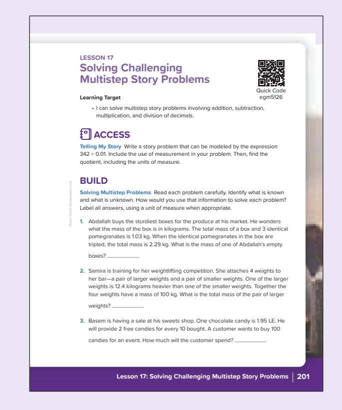
Telling My Story

Write 342 ÷ 0.01 on the board and ask students what the problem could mean. Ask students to write a story problem that matches $342 \div 0.01$ and includes measurement. If time permits, ask a few volunteers to share their story problems with the class.

Answer Key for Telling My Story

Story problems will vary. Accept all story problems that reflect the problem $342 \div 0.01$ and include measurement.

Student Page 201



BUILD (40 min) 

Solving Multistep Problems (20 min)

1. Remind students that they solved multistep problems using addition, subtraction, and multiplication in the previous concept. Inform students that they will be solving multistep problems using all four operations in this lesson. Briefly review the characteristics of good mathematicians.
2. Select a student to read the first problem aloud. Ask students to help you solve the problem as you model the solution on the board:
   - Ask students to identify what is known and unknown.
   - Ask students to identify what information can be used to solve the problem.
   - Draw a diagram showing the relationships in the problem.
3. Repeat the process with Problem 2.
4. Ask students to work with their Shoulder Partner to follow the problem-solving steps to solve Problem 3. As students work, walk around the room and identify students who can model a solution. With 5 minutes remaining in the segment, ask a partner team to show their work on the board.

Solving Multistep Problems
Teacher Note for #1:

There is more than one way to solve the story problems in this lesson. The answer keys model one solution. Consider alternate strategies and accept other methods which are efficient and effective.

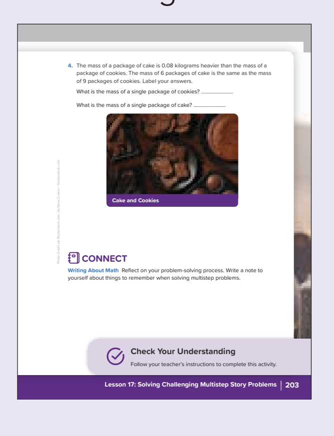
Answer Key for Solving Multistep Problems

1. 0.4 kg (Possible solution: 2.29 – 1.03 = 1.26 which is the mass of 6 pomegranates; 1.26 ÷ 2 = 0.63 which is the mass of 3 pomegranates; 1.03 – 0.63 = 0.4)
2. 62.4 kg (Possible solution: 100 ÷ 2 = 50 which is the mass of one small and one large weight; 50 – 12.4 = 37.6 which is the mass of 2 small weights; 37.6 ÷ 2 = 18.8 which is the mass of one small weight; 18.8 + 12.4 + 18.8 + 12.4 = 62.4)
3. 163.8 LE (Possible solution: Basem gets 12 candies for 19.5 LE and 12 × 8 = 96 so 96 candies cost 156 LE; 4 additional candies cost 7.80 LE; 156 + 7.80 = 163.8)

Partner Problem Solving Teacher Note for #1:

Problem 4 is challenging. Consider assigning it to students who are ready for an additional level of rigor.

Student Page 203



Partner Problem Solving (20 min)

1. Assign each pair of students one problem to solve. Go over the directions with students and distribute poster materials. Encourage students to use diagrams and show the equations and the solutions used throughout the problem.
2. Collect posters. Group the posters that illustrate the same problem and display them around the room. Have students do a Gallery Walk to compare problem-solving strategies.

Answer Key for Partner Problem Solving

1. 21 km and 60 m (Possible solution: $42.12 \div 2 = 21.06 = 21$ km and 60 m)
2. 0.725 L (Possible solution: 250 mL = 0.25 L; $18 + 0.25 = 18.25$ L; $18.25 - 0.85 = 17.4$; $17.4 \div 24 = 0.725$)
3. 40 pots (Possible solution: $2.8 \times 5 = 14$; $30 - 14 = 16$; $16 \div 0.4 = 40$)
4. 0.16 kg (cookies); 0.24 kg (cake) (Possible solution: If a package of cake = a package of cookies + 0.08 kg, then the mass of 3 packages of cookies = $0.08 \times 6 = 0.48$ kg; $0.48 \div 3 = 0.16$ kg for a package of cookies; $0.16 + 0.08 = 0.24$ kg for a package of cake)



CONNECT (7 min)



Writing About Math

Discuss the prompt with students and give them time to respond.

Answer Key for Writing About Math

Accept all appropriate responses.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Record and display students' ideas.

PRACTICE

1. 10.68 kg
2. 5.75 m
3. 6.92

CONCEPT CHECK-IN AND REMEDIATION
Dividing Decimals

DIGITAL



Quick Code: egmt5128

Lesson Overview

In this lesson, students work to correct misconceptions and errors related to Concept 2 Strategies for Dividing Decimals. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What strategies can be used to predict the placement of the decimal point when multiplying and dividing decimals?
- How does understanding place value help us multiply and divide decimals efficiently?
- How are decimals used in measurement?
- What is the meaning of division with decimals?
- What is the relationship between the size of the factors and the size of the product when dividing decimals?
- What strategies can be used to multiply and divide decimals?
- How are decimals used in solving real-world measurement problems involving measurement?

Lesson Learning Objective

- Students will correct misconceptions and errors related to decimal division.

Grade-Level Standards

5.A.3 Perform operations with multidigit whole numbers and with decimals to Hundredths.

5.A.3.c Add, subtract, multiply, and divide decimals to Thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

5.A.4.a Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten (for example, when multiplying .04 by 10, the decimal point will move one place to the right, but when multiplying .04 by 100, the decimal point will move two places to the right).

5.C.1.c Multiply and divide decimal numbers by 10, 100, and 1,000.

5.D.1 Solve problems involving measurement and conversion of measurements.

5.D.1.a Convert among various standard measurement units within a given system (for example, convert 5 cm to 0.05 m).

5.D.1.b Use unit conversions in solving multistep, real-world problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused by which direction to move the decimal point when dividing decimals.
- Students may assume division will always result in a smaller quotient.
- Students may struggle when they need to use zeros as placeholders in a number when dividing by powers of 10.
- Students may have difficulty understanding that when multiplying and dividing by whole number and decimal powers of 10, problems with opposite operations can have the same answer.
- Students may not be used to the divisor being greater than the dividend, resulting in a quotient less than 1.
- Students may flip the divisor and dividend when the divisor is greater to make the problem seem more familiar to them.
- Students may round both the divisor and the dividend to the nearest whole number. This does not always provide a quick mental calculation for estimating the quotient.
- Students sometimes make the remainder the decimal.
- Students sometimes have difficulty understanding that placing a decimal and a zero to the right of the Ones place does not change its value.
- Students might misplace the decimal point in the quotient in relation to the decimal point in the dividend, resulting in digits in the quotient with the incorrect value.
- Students sometimes multiply either the divisor or the dividend by a power of 10 or multiply the divisor and the dividend by different powers of 10.
- Students may struggle to understand story problems or to answer them thoroughly if they do not have a problem-solving plan prior to answering the question.
- Students may be confused by how to treat the decimal point in decimal division problems.

Remediation: Correcting Misconceptions

If . . . Students confuse which direction to move the decimal point.	**Then . . .** Review Lesson 11 BUILD. Allow students to use a notecard with rules written on it for what direction the decimal point moves when doing the following actions: 1. multiplying by a whole number; 2. multiplying by a decimal; 3. dividing by a whole number, and 4. dividing by a decimal.
If . . . Students assume dividing will always result in a smaller quotient.	**Then . . .** Review Lesson 13 BUILD. Encourage extra practice with Base 10 blocks to model division with decimals. Be sure to discuss the possible meaning of problems prior to solving.
If . . . Students misplace the decimal point in the quotient.	**Then . . .** Review Lesson 15 and 16 BUILD. Reinforce using estimation to place the decimal point correctly. Model moving the decimal point and placing it in the quotient prior to dividing.
If . . . Students do not multiply the dividend and divisor by the same powers of 10.	**Then . . .** Review Lesson 16 ACCESS, BUILD, and CONNECT. Emphasize that multiplying the divisor and dividend by the same power of 10 results in the same quotient using whole numbers with known quotients.

UNIT

6

NUMERICAL EXPRESSIONS AND PATTERNS

Theme 2 | Mathematical Operations and Algebraic Thinking

ESSENTIAL QUESTIONS

- Why does the order in which operations are performed matter when solving problems?
- How is the order of operations used to evaluate expressions?
- How do grouping symbols change the meaning of a numerical expression?
- How can we describe relationships between numbers?
- What strategies can be used to extend patterns?
- How does recognizing and extending patterns help to solve problems?

Video Questions



Quick Code
egmt5129

The Unit 6 Opener Video, Calculating Meals, explores math around Egypt through numerical expressions and patterns. In this unit, students learn to apply the order of operations to evaluate numerical expressions. They use expressions to identify and extend numerical patterns.

- How did the students use numerical expressions to make sense of the world around them?
- What did the students discover about numerical expressions?



Key Vocabulary



Quick Code
egmt5130

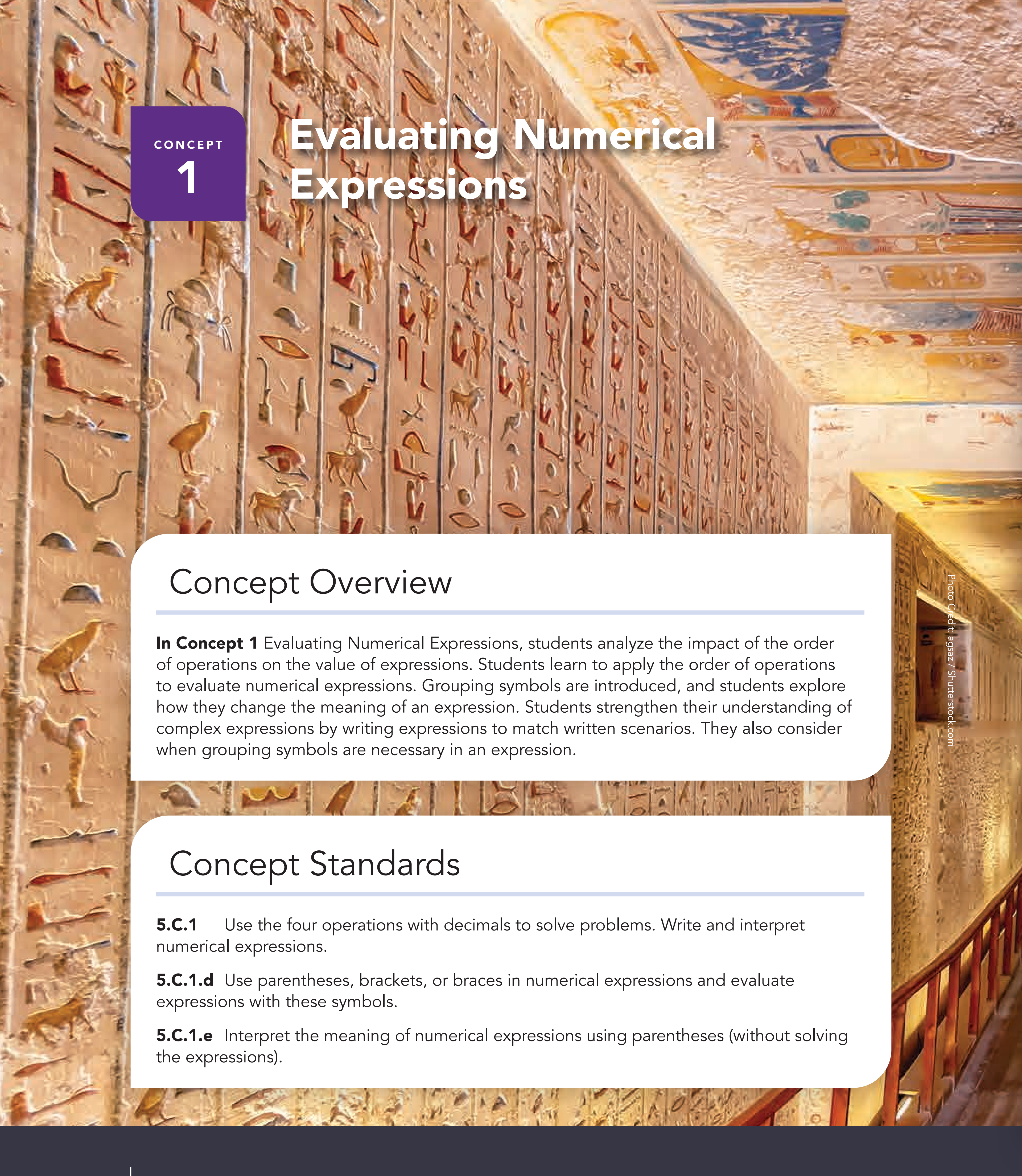
As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

brackets, input, numerical pattern, order of operations, output, parentheses, rule, variable

Photo Credit: Anton Petrus / Shutterstock.com

Mathematical Background Knowledge

In this unit, students apply their computational skills with whole numbers and decimals to evaluate expressions using the order of operations. They explore grouping symbols and analyze how those symbols can change the order in which an expression is evaluated and the value of an answer. Students also use their computational skills to describe relationships between numbers and to extend and create patterns. They utilize their understanding of the order of operations to write and apply rules for various types of patterns.



CONCEPT 1

Evaluating Numerical Expressions

Concept Overview

In Concept 1 Evaluating Numerical Expressions, students analyze the impact of the order of operations on the value of expressions. Students learn to apply the order of operations to evaluate numerical expressions. Grouping symbols are introduced, and students explore how they change the meaning of an expression. Students strengthen their understanding of complex expressions by writing expressions to match written scenarios. They also consider when grouping symbols are necessary in an expression.

Concept Standards

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.d Use parentheses, brackets, or braces in numerical expressions and evaluate expressions with these symbols.

5.C.1.e Interpret the meaning of numerical expressions using parentheses (without solving the expressions).

LESSON 1
Numerical Expressions

Lesson Overview
In this lesson, students use the order of operations to evaluate expressions including whole numbers and decimals. They build understanding of the importance of the order of operations. Students also analyze the impact of the order of operations on the value of expressions.

Lesson Essential Questions
- Why does the order in which operations are performed matter when solving problems?
- How is the order of operations used to evaluate expressions?

Lesson Learning Objective
- Students will use the order of operations to evaluate expressions with whole numbers and decimals.

Grade-Level Standard
5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

COMMON MISCONCEPTIONS AND ERRORS
- Students may always evaluate expressions from left to right without considering the operations involved.
- Students may think they need to complete all addition before subtracting or all multiplication before dividing. Students may not consider the proper order of operations.

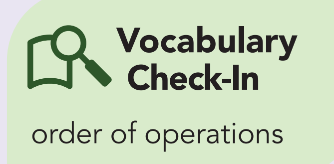
ACCESS (10 min) 

Fill in the Blank
1. Ask students to explain how relationships between inverse operations can often be used to solve for missing values in equations. Instruct students to solve the equations and record their answers.
2. Go over the answers for Problems 1 to 3 together. Ask students to discuss the strategies they used to solve Problems 1 to 3. Record all possible answers students concluded for Problem 4 on the board. Do not confirm answers as correct or incorrect. Problem 4 will be discussed in BUILD.

DIGITAL



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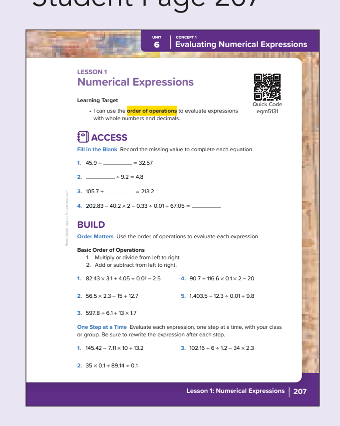
order of operations

VIDEO LESSON



Quick Code: egmt5132

Student Page 207



Answer Key for Fill in the Blank

1. 13.33
2. 44.16
3. 107.5
4. 156.48

BUILD (40 min)




Order Matters (30 min)

1. Ask students to share what they remember about the order of operations. Record accurate answers on the board.
2. Review the order of operations. Write on the board: Multiplication or division from left to right. Then, addition or subtraction from left to right. Explain to students that they will learn a more thorough and complex version of the order of operations in the next lesson.
3. Write $202.83 - 40.2 \times 2 - 0.33 \div 0.01 + 67.05$ on the board. Model how to evaluate the expression and substitute values.
4. Ask students to solve Problem 1. After a few minutes, ask students to share their answers. Do not confirm answers as correct or incorrect. Ask volunteers to help you model how to evaluate the expression on the board. $82.43 \times 3.1 = 255.533$ and $4.05 \div 0.01 = 405$; $255.533 + 405 = 660.533$; $660.533 - 2.5 = 658.033$.
5. Ask students to complete Problems 2 to 5 one at a time. Go over each answer with the class before continuing to the next problem.

Answer Key for Order Matters

1. 658.033
2. 127.65
3. 120.1
4. 94.02
5. 183.3

One Step at a Time
Teacher Note:

This activity can be completed as a whole class or in groups of three students. Consider the needs of the students when deciding how to structure the activity.

One Step at a Time (10 min)

If completing as a class, invite one student to the board to complete one step in evaluating each of the problems. If completing in small groups, instruct students to take turns completing one step in evaluating each of the problems.

Answer Key for One Step at a Time

1. 87.52
2. 894.9
3. 28.95



CONNECT (7 min)

The Right Route

Ask students to determine the correct route based on the order of operations.

Answer Key for The Right Route

1. Stop 1: B
2. Stop 2: E
3. Stop 3: M
4. Stop 4: P

WRAP-UP (3 min)





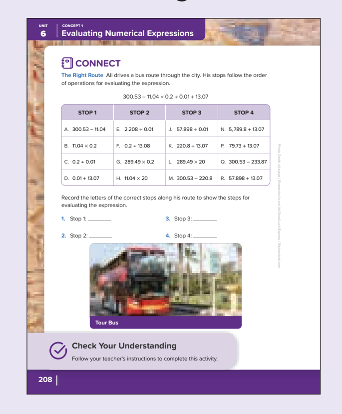
Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Ask students to discuss any questions they still have about the order of operations.

PRACTICE

1. 10.4×3.1
2. $34.5 \div 0.5$
3. 115.235
4. 26.718
5. 641.619

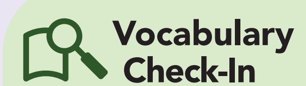
Student Page 208



DIGITAL



Quick Code: egmt5133



Vocabulary Check-In

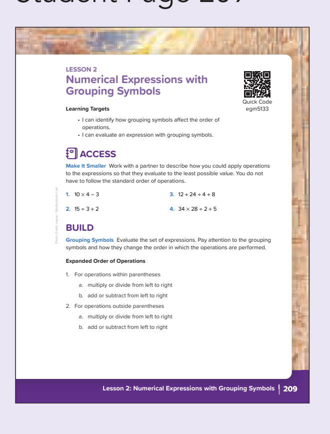
brackets, order of operations, parentheses

VIDEO LESSON



Quick Code: egmt5134

Student Page 209



LESSON 2
Numerical Expressions with Grouping Symbols

Quick Code egm5133

Learning Targets

- I can identify how grouping symbols affect the order of operations.
- I can evaluate an expression with grouping symbols.

ACCESS

Make It Smaller Work with a partner to describe how you could apply operations to the expressions so that they evaluate to the least possible value. You do not have to follow the standard order of operations.

1. $10 \times 4 - 3$
2. $15 \div 3 + 2$
3. $12 + 24 \div 4 + 8$
4. $34 \times 28 \div 2 + 5$

BUILD

Grouping Symbols Evaluate the set of expressions. Pay attention to the grouping symbols and how they change the order in which the operations are performed.

Expanded Order of Operations

1. For operations within parentheses
   a. multiply or divide from left to right
   b. add or subtract from left to right
2. For operations outside parentheses
   a. multiply or divide from left to right
   b. add or subtract from left to right

Lesson 2: Numerical Expressions with Grouping Symbols | 209

LESSON 2
Numerical Expressions with Grouping Symbols

Lesson Overview

In this lesson, students are introduced to a more complex version of the order of operations. The advanced version includes grouping symbols, such as parentheses and brackets. Students evaluate expressions with grouping symbols and discuss the effect of grouping symbols on the value of expressions.

Lesson Essential Questions

- Why does the order in which operations are performed matter when solving problems?
- How is the order of operations used to evaluate expressions?
- How do grouping symbols change the meaning of a numerical expression?

Lesson Learning Objectives

- Students will identify how grouping symbols affect the order of operations.
- Students will evaluate an expression with grouping symbols.

Grade-Level Standards

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.d Use parentheses, brackets, or braces in numerical expressions and evaluate expressions with these symbols.

5.C.1.e Interpret the meaning of numerical expressions using parentheses (without solving the expressions).

> COMMON MISCONCEPTIONS AND ERRORS
>
> If there is more than one operation within a set of grouping symbols, students may not be sure which operation to do first.



ACCESS (10 min)



Make It Smaller

1. Write $10 \times 4 - 3$ (Problem 1) on the board. Ask a student to evaluate the expression or model for the class using the standard order of operations.

2. Ask students how the solution would change if the subtraction was completed first. The answer would be 10, which is incorrect.

3. Instruct students to work with a partner to determine the order in which to perform the operations so that the solution to each problem has the smallest value possible. Students may share their thinking with a partner. Remind students that they do not have to follow the standard order of operations.

Answer Key for Make It Smaller

1. 10; subtract $4-3$, then multiply 10×1
2. 3; add $3+2$, then divide $15\div 5$
3. 3; add $12+24$ and $4+8$, then divide $36\div 12$
4. 136; add $2+5$, divide $28\div 7$, then multiply 34×4

BUILD (40 min) 

Grouping Symbols (12 min)

1. Write the following on the board (leave room to add another set of steps after Step 1 and before Step 2):
   1. For operations within parentheses
      a. multiply or divide from left to right
      b. add or subtract from left to right
   2. For operations outside of parentheses
      a. multiply or divide from left to right
      b. add or subtract from left to right

2. Write $(45.51+0.09)\div 2+3.45\times 0.1$ on the board. Explain that grouping symbols can be used to indicate what to do first when evaluating an expression. Model evaluating the expression. $45.51+0.09=45.6$; $45.6\div 2=22.8$ and $3.45\times 0.1=0.345$; $22.8+0.345=23.145$

3. Ask students to evaluate the expressions in Set A following the order of operations. Once students have finished, have them identify expressions that have the same value.

4. Review answers to Set A as a class. Discuss how Problem 3 has parentheses but has the same solution as Problem 1. Explain that sometimes grouping symbols do not have an effect on a solution when evaluating an expression.

Answer Key for Grouping Symbols

Set A

1. 66.376
2. 29.704
3. 66.376
4. 88.728
5. 91.599

Grouping Symbols, Advanced (13 min)

1. Revise the order of operations on the board to read:
   1. For operations within parentheses
      a. multiply or divide from left to right
      b. add or subtract from left to right
   2. For operations within brackets
      a. multiply or divide from left to right
      b. add or subtract from left to right
   3. For operations outside of parentheses or brackets
      a. multiply or divide from left to right
      b. add or subtract from left to right
2. Write $[34.8 \div (4 + 4)] \times 18 - 5.25 \times 2$ on the board. Explain that brackets (sometimes called braces) are another type of grouping symbol that give more information on how to evaluate an expression. Discuss the new order of operations.
3. Ask students to help you evaluate the expression. $34.8 \div 8 = 4.35$; $4.35 \times 18 = 78.3$ and $5.25 \times 2 = 10.5$; $78.3 - 10.5 = 67.8$
4. Instruct students to follow the new order of operations to evaluate the expressions in Set B. When finished, students should identify any expressions that have the same value.
5. Review answers as a class. If time permits, ask students to discuss the following questions:



- *What impact did the grouping symbols have on how the expressions were evaluated? They changed the order in which the operations are evaluated.*
- *Did any of the expressions have the same value? Why? They do not all have the same value because the value changes depending on which operation is solved first.*
- *What was the most challenging part of this activity? Answers vary.*

Answer Key for Grouping Symbols, Advanced

Set B

1. 90.98
2. 554.4
3. 13,293
4. 1,190.6
5. 13,968

How Many Values? (15 min)

1. Instruct students to use parentheses and brackets to create as many different values for the expressions as they can. Explain that it is possible that students will create a problem that they cannot solve. If students get stuck, encourage them to try another problem.
2. After about three minutes, ask students to share their work with a partner. Repeat for the remaining expressions.

Answer Key for How Many Values?

Answers will vary. Accept all accurate responses.



CONNECT (7 min)



Place the Grouping Symbols

Ask students to work independently to complete the learning activity.

Answer Key for Place the Grouping Symbols

Possible answers include $15.25 \div (2+3) + 6.8 \div 2$; $[15.25 \div (2+3)] + 6.8 \div 2$; or $15.25 \div (2+3) + (6.8 \div 2)$.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Ask students what other grouping symbols could be used to not change the value of the answer. Possible answers: $15.25 \div (2+3) + (6.8 \div 2)$; $[15.25 \div (2+3)] + 6.8 \div 2$

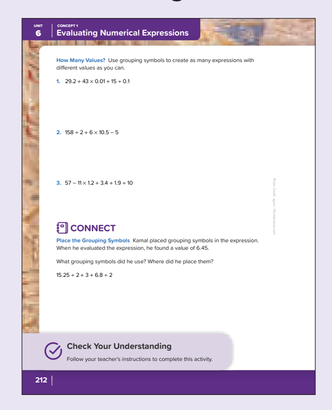
PRACTICE

1. $1.3 + 1.56$
2. $22.5 - 11.13$
3. 18.88
4. 2,347.4
5. 2.48

How Many Values?
Teacher Note for #2:

This activity could be used as a game. Whichever partner uses grouping symbols to create more expressions with different values earns a point. Each problem is a new round and a new opportunity for students to earn points. At the end, the partner with the most points wins.

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Let's Chat About Our Learning
Teacher Note:

This will help prepare students for the next lesson where they will explore more about grouping symbols and when grouping symbols are necessary in an expression.

DIGITAL



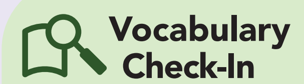
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Materials List

- Display cards

Preparation

- Create three large display cards for each digit 0 to 9.
- Create three large display cards for each of these symbols. ( ) + − × ÷ =



Vocabulary Check-In

order of operations, parentheses, brackets

VIDEO LESSON



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LESSON 3
Placing Grouping Symbols

Lesson Overview

In this lesson, students develop a deeper understanding of grouping symbols and how they can change the order of operations in an equation. They evaluate expressions with grouping symbols and place grouping symbols in expressions to generate given values.

Lesson Essential Questions

- Why does the order in which operations are performed matter when solving problems?
- How is the order of operations used to evaluate expressions?
- How do grouping symbols change the meaning of a numerical expression?

Lesson Learning Objective

- Students will evaluate expressions with grouping symbols.
- Students will place grouping symbols in expressions to generate given values.

Grade-Level Standards

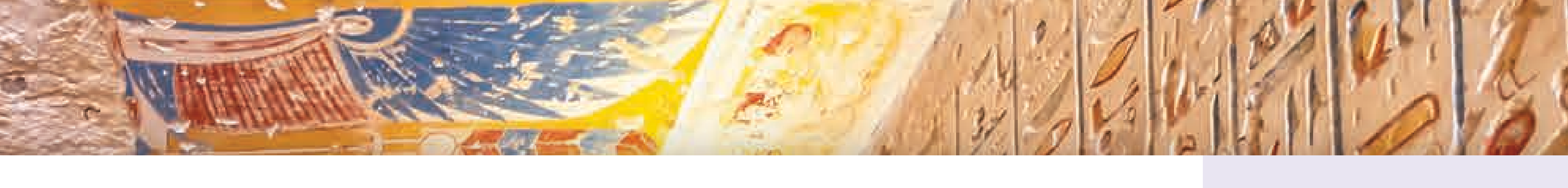
5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.d Use parentheses, brackets, or braces in numerical expressions and evaluate expressions with these symbols.

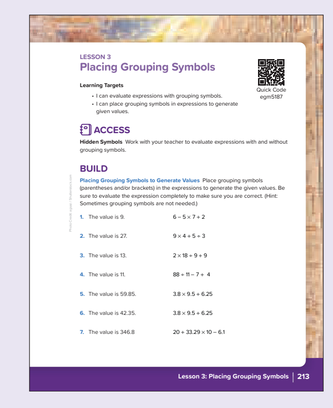
5.C.1.e Interpret the meaning of numerical expressions using parentheses (without solving the expressions).

COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes struggle to understand that placing grouping symbols in an expression may change its value.
- Students may have difficulty placing multiple sets of parentheses in an expression or placing brackets around parentheses to generate a given value.
- Students may use unnecessary grouping symbols to achieve a given value.



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LESSON 3

Placing Grouping Symbols

Quick Code egm5187

Learning Targets

- I can evaluate expressions with grouping symbols.
- I can place grouping symbols in expressions to generate given values.

ACCESS

Hidden Symbols Work with your teacher to evaluate expressions with and without grouping symbols.

BUILD

Placing Grouping Symbols to Generate Values Place grouping symbols (parentheses and/or brackets) in the expressions to generate the given values. Be sure to evaluate the expression completely to make sure you are correct. (Hint: Sometimes grouping symbols are not needed.)

1. The value is 9. 6 – 5 × 7 + 2
2. The value is 27. 9 × 4 + 5 ÷ 3
3. The value is 13. 2 × 18 ÷ 9 + 9
4. The value is 11. 88 ÷ 11 – 7 + 4
5. The value is 59.85. 3.8 × 9.5 + 6.25
6. The value is 42.35. 3.8 × 9.5 + 6.25
7. The value is 346.8 20 + 33.29 × 10 – 6.1

Photo Credit: agsaz / Shutterstock.com

Lesson 3: Placing Grouping Symbols | 213



ACCESS (10 min)



Hidden Symbols

1. Invite nine students to the front of the room. Distribute digit and symbol cards to the students and help them stand in order to form the expression 8 + 4 × 14 – 10 ÷ 2. (Two students will hold two cards.)
2. Ask seated students to use the order of operations to help you evaluate the expression. For example, students should recognize that they must multiply 4 × 14 first. Have those three students step forward, ask students to find the product, then replace those three students with a student holding digits 5 and 6. Rearrange students and collect and distribute digit and symbol cards as needed to illustrate each step.
3. Then, invite students up to hold cards to display the answer (= 59).

   8 + 4 × 14 – 10 ÷ 2

   8 + 56 – 5

   64 – 5 = 59
4. Ask a new set of volunteers to recreate the original expression 8 + 4 × 14 – 10 ÷ 2. Ask students to discuss what they remember about grouping symbols and how they can change the order of operations and the value of expressions. Clarify misconceptions.
5. Challenge students to think of how they would use parentheses in the expression to generate a value of 16. Allow students to talk to partners to share their ideas.
6. Invite volunteers to represent parentheses in the expression using symbols cards. Ask seated students to check the work. Emphasize that grouping symbols do not always change the value of an expression and are not always needed. In this case, however, students were able to change the value using parentheses.

Answer Key for Hidden Symbols

8 + 4 × (14 – 10) ÷ 2 = 16

BUILD (40 min)



Placing Grouping Symbols to Generate Values

1. Discuss the directions with students. Consider different options for grouping students based on their level of understanding. Students may work independently, in pairs, in small groups, or as a whole class using the digit and symbol cards. Give students about 30 minutes to work on Problems 1 through 10.

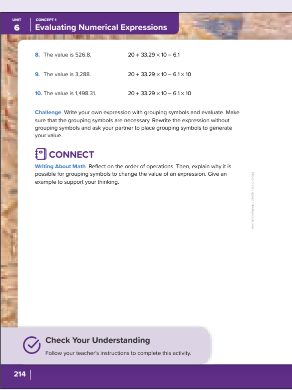
2. Go over the answers together. If students did not work as a whole group, ask volunteers to share their answers using their classmates and the digit and symbol cards. Discuss why some of the problems needed grouping symbols and some did not.

Answer Key for Placing Grouping Symbols to Generate Values

1. (6 – 5) × 7 + 2
2. 9 × (4 + 5) ÷ 3
3. 2 × 18 ÷ 9 + 9
4. 88 ÷ (11 – 7 + 4)
5. 3.8 × (9.5 + 6.25)
6. 3.8 × 9.5 + 6.25
7. 20 + 33.29 × 10 – 6.1
8. (20 + 33.29) × 10 – 6.1
9. 20 + (33.29 × 10 – 6.1) × 10
10. [20 + (33.29 × 10 – 6.1)] × 10

Challenge Answers will vary. Accept all accurate expressions.

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CONNECT (7 min)



Writing About Math

Ask students to reflect on the order of operations as they respond to the prompts.

Answer Key for Writing About Math

The grouping symbols allow for the operations to be performed in a different order. Accept all accurate examples.

WRAP-UP (3 min)





Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt, including their examples. Encourage students to ask each other questions to build understanding and clear up misconceptions.

PRACTICE

1. 58.5
2. 27
3. 63.95
4. 128.46
5. 62.92



LESSON 4

Writing Expressions to Represent Scenarios

Lesson Overview

In this lesson, students use the order of operations and grouping symbols to write expressions to match a given situation.

Lesson Essential Questions

- Why does the order in which operations are performed matter when solving problems?
- How do grouping symbols change the meaning of a numerical expression?

Lesson Learning Objective

- Students will write an expression to represent a written scenario.

Grade-Level Standards

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.d Use parentheses, brackets, or braces in numerical expressions and evaluate expressions with these symbols.

5.C.1.e Interpret the meaning of numerical expressions using parentheses (without solving the expressions).

COMMON MISCONCEPTIONS AND ERRORS

Students may unnecessarily use parentheses to indicate what to do first in an expression. For example, they might write $25 \times 5 - 19$ as $(25 \times 5) - 19$. While this is not incorrect, this is not the most efficient way to write the expression.





ACCESS (10 min)

With or Without

Ask students to complete the learning activity. Go over the answers and ask students to explain when parentheses change the value of the expression and why they think there are different answers. Parentheses are not needed if they are around multiplication or division because those operations are already performed first in the order of operations.

DIGITAL



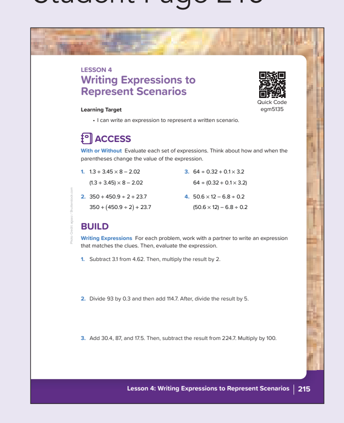
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VIDEO LESSON



Quick Code: egmt5136

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LESSON 4

Writing Expressions to Represent Scenarios

Quick Code egm5135

Learning Target

- I can write an expression to represent a written scenario.

ACCESS

With or Without Evaluate each set of expressions. Think about how and when the parentheses change the value of the expression.

1. $1.3 + 3.45 \times 8 - 2.02$
   $(1.3 + 3.45) \times 8 - 2.02$
2. $350 + 450.9 \div 2 + 23.7$
   $350 + (450.9 \div 2) + 23.7$
3. $64 \div 0.32 + 0.1 \times 3.2$
   $64 \div (0.32 + 0.1 \times 3.2)$
4. $50.6 \times 12 - 6.8 \div 0.2$
   $(50.6 \times 12) - 6.8 \div 0.2$

BUILD

Writing Expressions For each problem, work with a partner to write an expression that matches the clues. Then, evaluate the expression.

1. Subtract 3.1 from 4.62. Then, multiply the result by 2.
2. Divide 93 by 0.3 and then add 114.7. After, divide the result by 5.
3. Add 30.4, 87, and 17.5. Then, subtract the result from 224.7. Multiply by 100.

Lesson 4: Writing Expressions to Represent Scenarios | 215

Answer Key for With or Without

1. 26.88; 35.98
2. 599.15; 599.15
3. 200.32; 100
4. 573.2; 573.2

BUILD (40 min) 

Writing Expressions (20 min)

1. Direct students' attention to the order of operations on the board. Go over the directions for the learning activity. Then, ask students to work with a partner to complete the problems.
2. Go over the answers together. Ensure that students have written the correct expression and used proper grouping symbols when necessary. Allow time for students to revise their expressions if needed.

Answer Key for Writing Expressions

1. $(4.62-3.1)\times 2=3.04$
2. $(93\div 0.3+114.7)\div 5=84.94$
3. $[224.7-(30.4+87+17.5)]\times 100=8{,}980$
4. $(7.6\times 100-34.3+12.4)\div 0.1=7{,}381$
5. $1{,}168\div[(10-9.27)\times(54+46)]=16$

Expressions and Story Problems (20 min)

1. Read Problem 1 to students and give them time to write an expression.
2. Write $1{,}000+(50\times 4)+(30\times 4)$ on the board. Ask students to give a Thumbs-Up if they think the expression matches the situation and a Thumbs-Down if they think that it does not. Invite students to share their ideas. The expression matches the situation.
3. Ask students to talk with their Shoulder Partner about another way to write the expression. Ask students to share their ideas and record other expressions on the board.
4. If a student has not suggested $1{,}000+[(50+30)\times 4]$, write this expression on the board. Discuss the meaning of this expression and whether it will match the situation when evaluated.
5. Ask students whether the grouping symbols are necessary in this expression. Write $1{,}000+(50+30)\times 4$ on the board.
6. Explain that in this expression, the parentheses are necessary but the brackets are not. The most efficient way to write the expression is $1{,}000+(50+30)\times 4$.



7. Assign students to partners or small groups and allow them to work on the remaining problems. Remind them to make sure their expressions are written in the most efficient way.

Answer Key for Expressions and Story Problems

1. $1{,}000 + (50 + 30) \times 4 = 1{,}320$ LE
2. $(100 - 33.75 \times 2) \div 2 = 16.25$ kg
3. $38.7 \div 2 \times 1{,}000 \div 60 = 322.5$ m (Since this expression only contains multiplication and division, the numbers and operations can be written in any order.)
4. $(15.75 - 3.75) \div 16 = 0.75$ L

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CONNECT (7 min)



Writing About Math

Ask students to respond to the CONNECT prompt.

Answer Key for Writing About Math

Answers will vary. Possible answers include: We can show what happened first by using parentheses and brackets. We can group together operations that happened together.

WRAP-UP (3 min)



Let's Chat About Our Learning

Lead a class discussion about the Lesson Essential Questions.

PRACTICE

1. $(612.14 + 33.46) \div 2 - 103.14 = 219.66$
2. $(127.9 + 25) \times (2.5 + 3.5) \times 0.1 = 91.74$
3. C. $708.24 - 113.5 \times 3.2 + 24.7 \div 5$
4. $(45 - 4.5 \times 5) \div 1.5 = 15$

DIGITAL



Quick Code:
egmt5137

CONCEPT CHECK-IN AND REMEDIATION
Evaluating Numerical Expressions

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Evaluating Numerical Expressions. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- Why does the order in which operations are performed matter when solving problems?
- How is the order of operations used to evaluate expressions?
- How do grouping symbols change the meaning of a numerical expression?

Learning Objective

- Students will work to correct misconceptions and errors related to evaluating numerical expressions.

Grade-Level Standards

5.C.1 Use the four operations with decimals to solve problems. Write and interpret numerical expressions.

5.C.1.d Use parentheses, brackets, or braces in numerical expressions and evaluate expressions with these symbols.

5.C.1.e Interpret the meaning of numerical expressions using parentheses (without solving the expressions).

COMMON MISCONCEPTIONS AND ERRORS

- Students may always evaluate expressions from left to right without considering the operations involved.
- Students may think they need to complete all addition before subtracting or all multiplication before dividing.
- Students may not consider the proper order of operations.
- Students may confuse which operation to start with if there is more than one operation within a set of grouping symbols.
- Students may unnecessarily use parentheses to indicate what to do first in an expression.

Remediation: Correcting Misconceptions

If . . .	Then . . .
Students always add before subtracting or always multiply before dividing, rather than working from left to right.	Review Lesson 1. Consider having students write down the steps of the order of operations for reference. Allow students to practice identifying the steps of evaluating the expression without solving.
If . . .	**Then . . .**
Students confuse which operation to start with within a set of brackets or parentheses.	Review Lesson 2. It may be helpful for some students to think of the parentheses as an expression within an expression. That means it has to follow the order of operations as well.

CONCEPT 2

Analyzing Numerical Patterns

Concept Overview

In Concept 2 Analyzing Numerical Patterns, students identify, describe, and extend patterns using their computation skills with whole numbers and decimals. Students find the rule for a given numerical pattern and apply the rule to extend the pattern or to find missing values within the pattern. Students work with a variety of different types of patterns. They explore patterns where there is a consistent change between the values, where the change in one pattern determines the change in another, and where the change depends on adding previous values in the pattern. Exploring patterns and number relationships is valuable for future success in algebra and beyond.

Concept Standards

5.A.2 Analyze patterns and relationships.

5.A.2.a Generate two numerical patterns using two given rules.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

LESSON 5
Identifying Numerical Patterns

Lesson Overview

In this lesson, students analyze visual and numerical patterns and look for relationships to describe how the patterns are changing. Students also look for patterns in an input–output table. Students are challenged to determine what operations were used in the table. They learn to write rules in words and use variables to represent an unknown input value.

Lesson Essential Question

- How can we describe relationships between numbers?

Lesson Learning Objectives

- Students will identify a numerical pattern.
- Students will explain the rule for a numerical pattern.
- Students will use letters to represent unknown quantities in a rule for a numerical pattern.

Grade-Level Standards

5.A.2 Analyze patterns and relationships.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

Students may identify a rule that only works for part of a set of numbers or only works for one pair of values in a table, but not for an entire pattern.





Tile Pattern

1. Tell students that the pictures show the first three stages of a pattern growing in a consistent way between each stage. Ask students to draw Stage 4 and Stage 5 and to predict how many tiles will be in Stage 10. If tiles are available, allow students to build the patterns with tiles prior to drawing.
2. Pair students to share their solutions. Bring the whole group back together and ask students to explain their strategies for figuring out how many tiles are in Stage 10. Guide students with questions about how the pattern is changing from stage to stage.

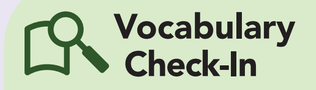
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Materials List

- Tiles (optional)



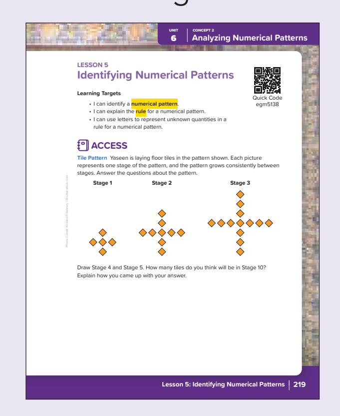
input, numerical pattern, output, rule, variable

VIDEO LESSON



Quick Code: egmt5139

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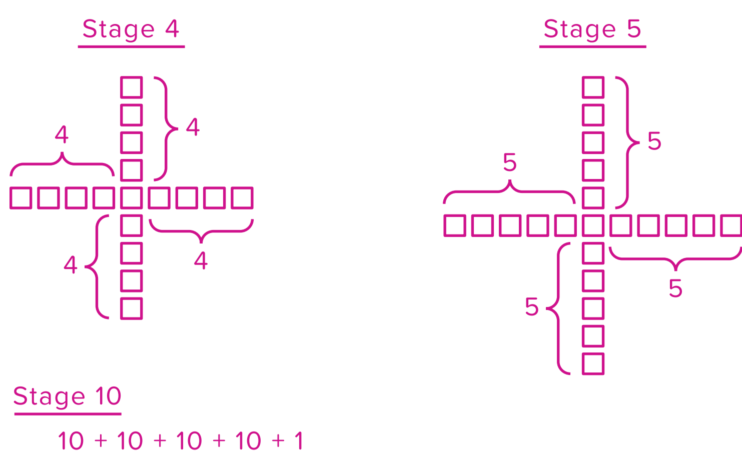




- *What is staying the same in each stage?* *There is always one tile in the center.*
- *What is changing?* *The number of tiles at the top, bottom, left, and right of the center tile changes.*
- *How is the pattern changing in each stage?* *One tile is added at the top, bottom, left, and right of the center tile in each stage. The number of tiles at the top, bottom, left, and right of the center tile is the same as the stage number.*

3. Write a numerical pattern on the board that matches the visual pattern. 5, 9, 13, 17, 21, and so on

Answer Key for Tile Pattern

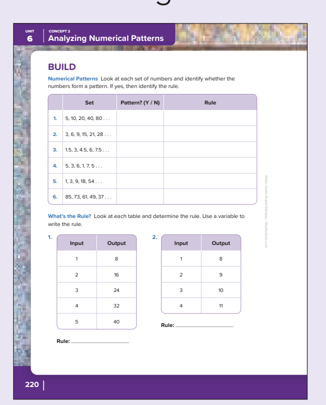


Stage 10

10 + 10 + 10 + 10 + 1

41 tiles; accept all explanations that involve using patterns.

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BUILD (35 min) 

Numerical Patterns (20 min)

1. Ask students to discuss how the visual pattern in ACCESS was turned into a numerical pattern. Define a numerical pattern as a sequence of numbers that change consistently following a rule.
2. Ask students to identify the rule for the numerical pattern on the board. Add 4.
3. Share with students that a numerical pattern must have a rule that works for all of the numbers in the pattern. Work through the first problem with students. Each number is multiplied by 2 to get the next number. The rule is multiply by 2.
4. Allow students to work independently or with a partner to complete Problems 2 to 6. Go over the answers together.

Answer Key for Numerical Patterns

1. Y; multiply by 2
2. N
3. Y; add 1.5
4. N
5. N
6. Y; subtract 12

What's the Rule? (15 min)

1. Explain to students that another way numerical patterns appear in math is in charts or tables.
2. Discuss the input–output table in Problem 1 and help students understand how to read it.
3. Do a Think Aloud as you model how to read and interpret the table in Problem 1. For example:
   - If 1 goes in and 8 comes out, addition or multiplication could have been applied.
   - Looking at the next pair of numbers helps to see that the rule is multiply by 8.
   - Make sure that the rest of the pairs in the table use the same rule.
   - I can use a variable to write the rule. Since any number can go in, the rule to describe the number that comes out is $n \times 8$.
4. Ask students to work independently or with a partner to solve Problems 2 to 6.

Answer Key for What's the Rule?

Accept any letter as the variable.

1. $n \times 8$
2. $n + 7$
3. $n \times 4$
4. $n \div 5$
5. $n \times 2$

Challenge $n \times 2 - 1$



CONNECT (7 min)



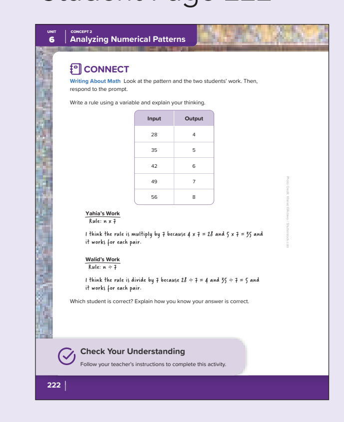
Writing About Math

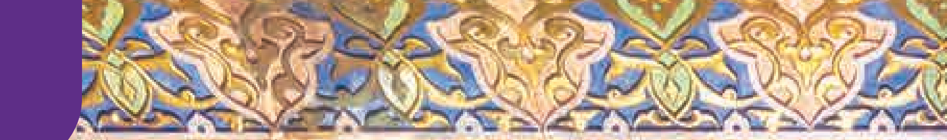
Ask students to look at the pattern and answer the questions.

Answer Key for Writing About Math

Walid's work is correct. Each input is divided to get the output. The input can be represented by a variable. When you plug the numbers into Walid's rule, you get the correct outputs for the table. Yahia's work is backwards. The output cannot be represented with a variable.

Student Page 222





WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to discuss their answers to CONNECT. Encourage students to ask each other questions and to help clear up misconceptions.

PRACTICE

Accept any letter as the variable.

1. $n - 2$
2. $n + 0.25$
3. $n + 10$
4. $n - 3$
5. $n \times 80$

LESSON 6
Extending and Creating Numerical Patterns

Lesson Overview

In this lesson, students extend their understanding of numerical patterns and rules. They find missing values in input–output tables. Students then create patterns and input–output tables using a given starting number and a rule.

Lesson Essential Questions

- How can we describe relationships between numbers?
- What strategies can be used to extend patterns?

Lesson Learning Objectives

- Students will extend a numerical pattern.
- Students will create a numerical pattern.
- Students will generate two numerical patterns using two given rules.

Grade-Level Standards

5.A.2 Analyze patterns and relationships.

5.A.2.a Generate two numerical patterns using two given rules.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

- Given an output, students sometimes have difficulty finding the input.
- Students sometimes get confused interpreting or applying a rule that has more than one step.

DIGITAL



Quick Code: egmt5140

Materials List

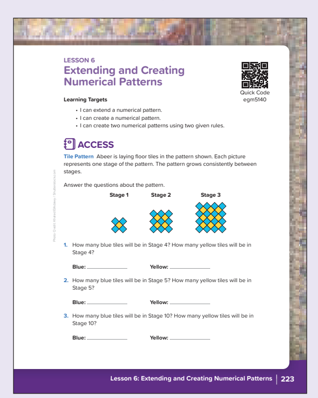
- Markers
- Tiles (optional)

VIDEO LESSON

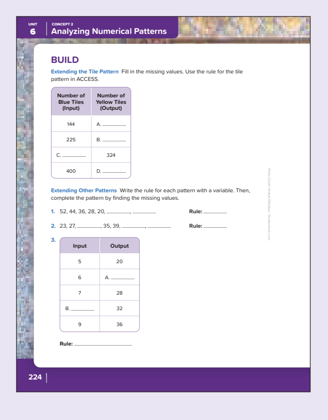


Quick Code: egmt5141

Student Page 223



Student Page 224



ACCESS (10 min)



Tile Pattern

1. Tell students that the pictures show the first three stages of a pattern growing in a consistent way between each stage. Ask students to answer the questions. If necessary, allow students to build the patterns with tiles if tiles are available. Pair students to share their solutions. Bring the whole group back together to share strategies for figuring out how many blue tiles and how many yellow tiles are in Stage 10. To get the number of blue tiles, you add 1 to the stage number and then multiply the sum by itself. The number of yellow tiles is the stage number times itself.
2. Ask students to talk with their partners about how to write this rule with a variable. If necessary, tell students that the stage number would be the variable and that their rules could include grouping symbols. Invite students to share their rules and record them on the board. Blue tiles: $(n+1)\times(n+1)$ Yellow tiles: $n\times n$

Answer Key for Tile Pattern

1. Blue: 25; Yellow: 16
2. Blue: 36; Yellow: 25
3. Blue: 121; Yellow: 100

BUILD (40 min)



Extending the Tile Pattern (10 min)

1. Explain that once a rule for a pattern is known, it is possible to extend that pattern. Remind students of the rule for the Tile Pattern in ACCESS. If necessary, rewrite the rule. Blue tiles: $(n+1)\times(n+1)$, Yellow tiles: $n\times n$
2. Ask students to look closely at the number of blue tiles in the first row of the table. Ask students how to find the value of n. Since $144=12\times12$, $n=11$. If $n=11$, find the number of yellow tiles in the pattern. $11\times11=121$
3. Instruct students to complete the table. Remind students to use the rule for each color. If students are struggling, remind them to start by finding the value of n.

Answer Key for Extending the Tile Pattern

A. 121; $(n+1)\times(n+1)=144$; $n=11$

B. 196; $(n+1)\times(n+1)=225$; $n=14$

C. 361; $n\times n=324$; $n=18$

D. 361; $(n+1)\times(n+1)=400$; $n=19$

Extending Other Patterns (15 min)

1. Ask students to determine the rule for Problem 1 and to give a Thumbs-Up when they have the rule in mind. Ask students to share the rule. Subtract 8 or $n-8$.
2. Ask students to help you apply the rule to extend the pattern to find the next two numbers in the sequence. 12, 4
3. Ask students to work with their Shoulder Partner to complete Problems 2 to 5. Explain that a missing number can occur at any point in a pattern. Remind students to test their rule for all of the numbers in the pattern before applying it to find any missing values. Also, remind students that a rule may be one operation or several operations.

Answer Key for Extending Other Patterns

1. 12, 4; $n-8$
2. 31, 43, 47; $n+4$
3. A. 24, B. 8; $n\times 4$
4. A. 14; $n\div 2+1$
5. A. 48, B. 51; $n-21$

Creating Patterns (15 min)

1. Go over the directions with students and ask them to work with a partner to complete Problem 1. Ask volunteers to share their answers. Record the pattern on the board.
2. Ask students to work independently or with a partner to complete Problems 2 to 5. Students create their own patterns in Problem 5. They will have an opportunity to share them during WRAP-UP.

Answer Key for Creating Patterns

1. 1, 4, 7, 10, 13
2. 3, 4.5, 7.5, 13.5, 25.5
3. 5.25, 10.5, 21, 42, 84
4. 11; 140; 1,430; 14,330; 143,330
5. Accept all accurate numerical patterns and rules.




CONNECT (5 min)

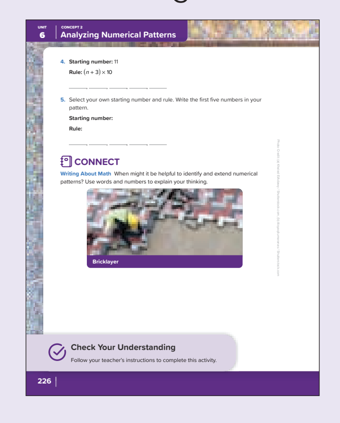
Writing About Math

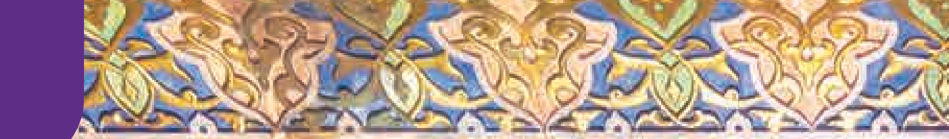
Ask students to respond to the CONNECT prompt.

Answer Key for Writing About Math

Answers will vary. Accept all reasonable responses that include an explanation.

Student Page 226





WRAP-UP (5 min)



Let's Chat About Our Learning

Invite volunteers to write their patterns from Problem 5 in Creating Patterns. Ask the rest of the class to determine the rule for each pattern. Discuss any rules that involve using the order of operations.

PRACTICE

1. 3, 5.4, 7.8, 10.2, 12.6

2. 0.36, 1.8, 9, 45, 225

3. 8.75

4. 14

5. 37

Challenge 1. $n \times 6 + 1$

Challenge 2. 139

LESSON 7
Solving Problems with Numerical Patterns

Lesson Overview
In this lesson, students take a new look at problem solving. They apply their learning about problem-solving strategies and numerical patterns to solve real-world problems. As students work, they discover that patterns and pattern rules can help them solve complex problems in their daily lives.

Lesson Essential Questions
- How can we describe relationships between numbers?
- What strategies can be used to extend patterns?
- How does recognizing and extending patterns help to solve problems?

Lesson Learning Objective
- Students will solve real-world problems involving numerical patterns.

Grade-Level Standards
5.A.2 Analyze patterns and relationships.

5.A.2.a Generate two numerical patterns using two given rules.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

> COMMON MISCONCEPTIONS AND ERRORS
>
> Students may have difficulty adding a previous value in a pattern rather than adding a consistent value when extending a pattern.


ACCESS (10 min)


What's the Rule?
Ask students to explore the pattern and try to extend it. Discuss the pattern with students. The rule is to add the two previous numbers to get the next number in the pattern. This is unique because numbers that are already part of the pattern are used to generate the next number.

Answer Key for What's the Rule?
55, 89

DIGITAL



Quick Code: egmt5142

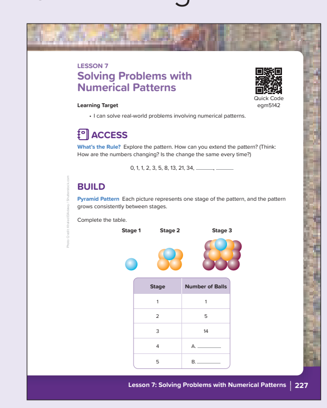
Materials List
- Thinking Like a Mathematician Anchor Chart
- Tiles (optional)

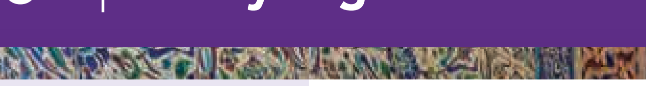
VIDEO LESSON



Quick Code: egmt5143

Student Page 227





BUILD (40 min)



Pyramid Pattern (10 min)

1. Ask students to complete the table with how many balls they think will be in Stage 4 and Stage 5. If tiles are available, allow students to build the patterns with tiles. Discuss and compare answers.
2. Ask students how they would describe the rule for this pattern. If the stage number is *n*, then $n \times n +$ previous number in the pattern.

Answer Key for Pyramid Pattern

A. 30

B. 55

Patterns in the Real World (30 min)

1. Direct students' attention to the Thinking Like a Mathematician Anchor Chart. Explain that one of the strategies mathematicians use when solving problems is to look for patterns. Ask students why looking for patterns might be a helpful strategy. Patterns can help simplify something that is complex. Patterns are predictable so they can be used to figure out information that is unknown.
2. Assign partners and direct each pair to solve Problems 1 and 2. After five minutes, discuss strategies and answers.
3. Ask students to work with their partner to solve Problems 3 and 4. After five minutes, discuss strategies and answers. Repeat for Problems 5 and 6.

Answer Key for Patterns in the Real World

1. 9
2. A. 12; B. 14; C. 19; D. 19; E. 24
3. A. 2.5; B. 5; C. 10
4. 17.5 m; 17 dresses
5. 3 LE; 2 LE
6. $2 + (n - 1) \times 3$

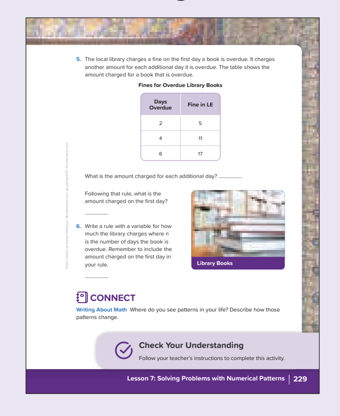
What's the Rule?
Teacher Note:

The pattern in What's the Rule? is a famous pattern called the Fibonacci sequence. The earliest descriptions of the Fibonacci sequence come from Indian mathematicians in the sixth century. Leonardo Fibonacci, an Italian mathematician, wrote about the sequence in his book *Liber Abaci*. The sequence eventually came to be known as Fibonacci numbers. Fibonacci numbers are often found in nature.

Patterns in the Real World
Teacher Note for #3:

For Problem 6, the rule must reflect that only 2 LE are charged on Day 1.

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CONNECT (7 min)



Writing About Math

Ask students to respond to the CONNECT prompt.

Answer Key for Writing About Math

Accept all reasonable answers.

WRAP-UP (3 min)



Let's Chat About Our Learning

Ask students to share their responses to the CONNECT prompt. Encourage students to ask each other questions and build on each other's ideas.

PRACTICE

A. $n \div 2 \times 3$

B. 1.2

C. 1.8

D. 2.7

E. 4.05




Quick Code:
egmt5144

CONCEPT CHECK-IN AND REMEDIATION
Analyzing Numerical Patterns

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Analyzing Numerical Patterns. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- How can we describe relationships between numbers?
- What strategies can be used to extend patterns?
- How does recognizing and extending patterns help to solve problems?

Learning Objective

- Students will correct misconceptions and errors related to analyzing numerical patterns.

Grade-Level Standards

5.A.2 Analyze patterns and relationships.

5.A.2.a Generate two numerical patterns using two given rules.

5.C.1.f Use letters to represent unknown quantities to solve equations and story problems.

COMMON MISCONCEPTIONS AND ERRORS

- Students may identify a rule that only works for part of a set of numbers or only works for one pair of values in a table, but not for an entire pattern.
- Students sometimes get confused interpreting or applying a rule that has more than one step.
- Students may have difficulty adding a previous value in a pattern rather than adding a consistent value when extending a pattern.

Remediation: Correcting Misconceptions

If . . .	Then . . .
Students identify a rule that only works for part of a set of numbers or only works for one pair of values in a table.	Review Lesson 5 BUILD. Ask students to write the rule between each of the numbers in the pattern or next to each pair of numbers in a table to make sure that the rule works.
If . . .	**Then . . .**
Students get confused interpreting or applying a rule that has more than one step.	Review Lesson 6. Remind students to apply the order of operations. Provide additional practice involving rules written with and without grouping symbols to show how the pattern changes depending on how the rule is written.

Primary 5 Resources

- Lesson Blackline Masters
- Glossary
- Index

Unit 1, Lesson 1
The Journey Begins

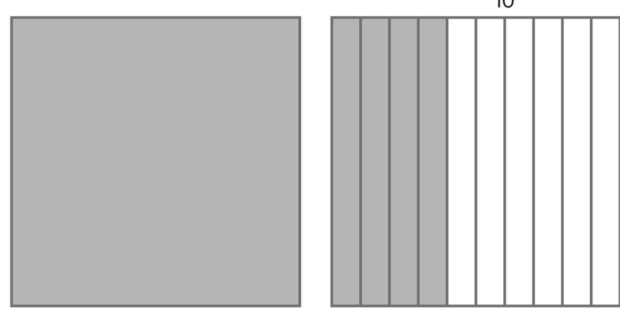
Tenths and Hundredths Anchor Chart

Instructions: Create a large version of the Tenths and Hundredths Anchor Chart.

Tenths and Hundredths

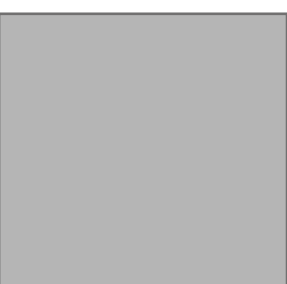
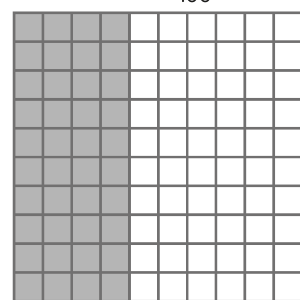
1.4

This number can be read as one and four tenths
and the decimal can be represented as $1\frac{4}{10}$ in fraction form.



It can also be written as 1.40.

This number can be read as one and forty hundredths
and the decimal can be represented as $1\frac{40}{100}$ in fraction form.

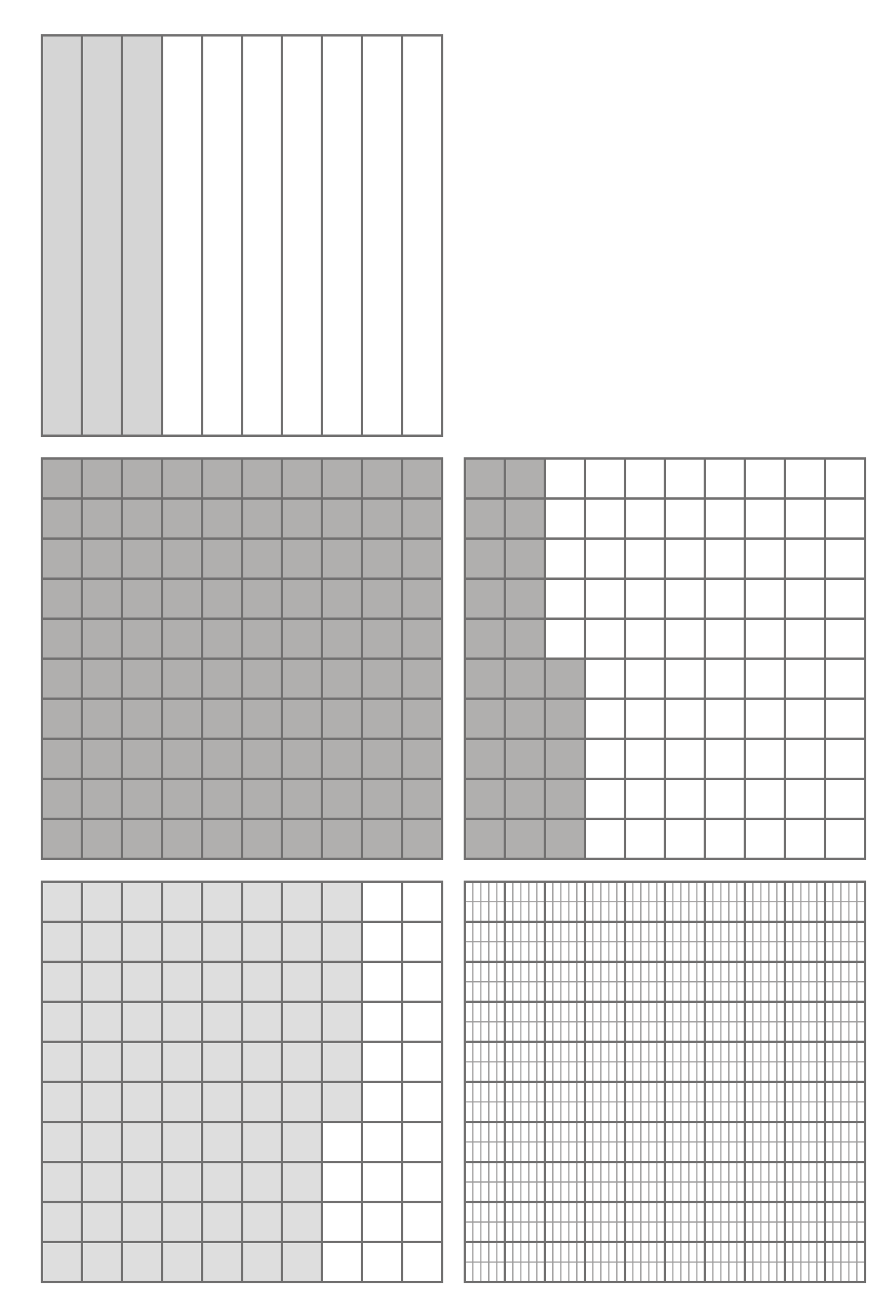



Unit 1, Lesson 2

Exploring Decimals to the Thousandths Place

Decimal Models

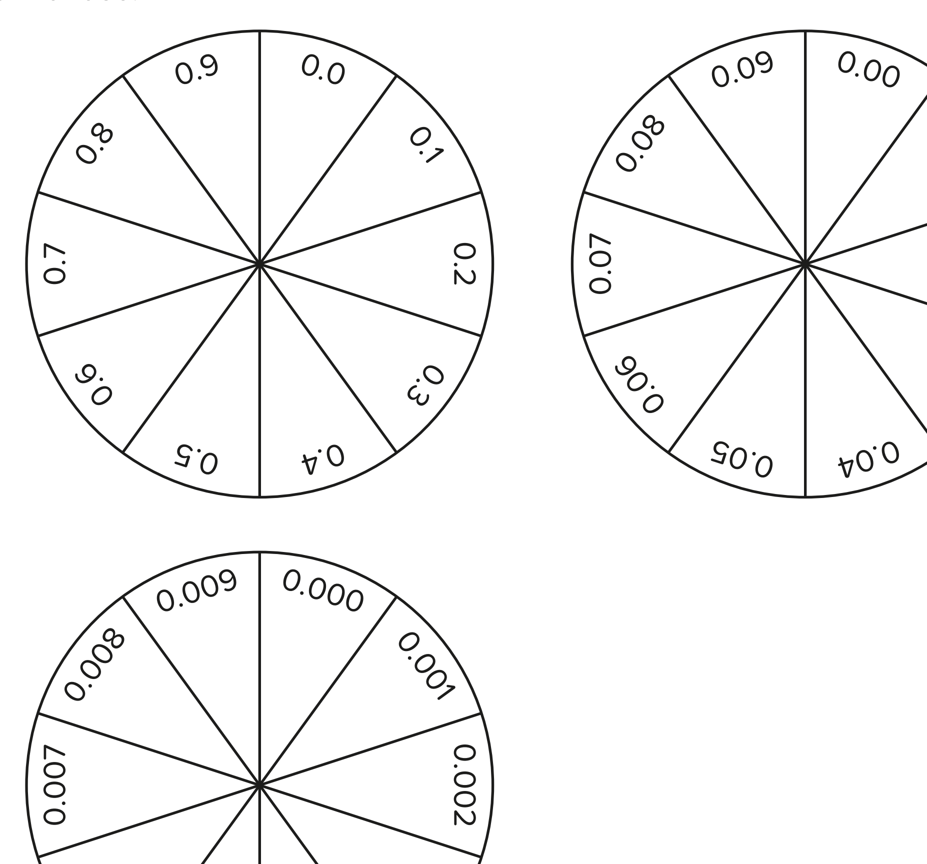
Instructions: Re-create (or photocopy and enlarge) large versions of the decimal models.



Unit 1, Lesson 2
Exploring Decimals to the Thousandths Place

Decimal Spinners

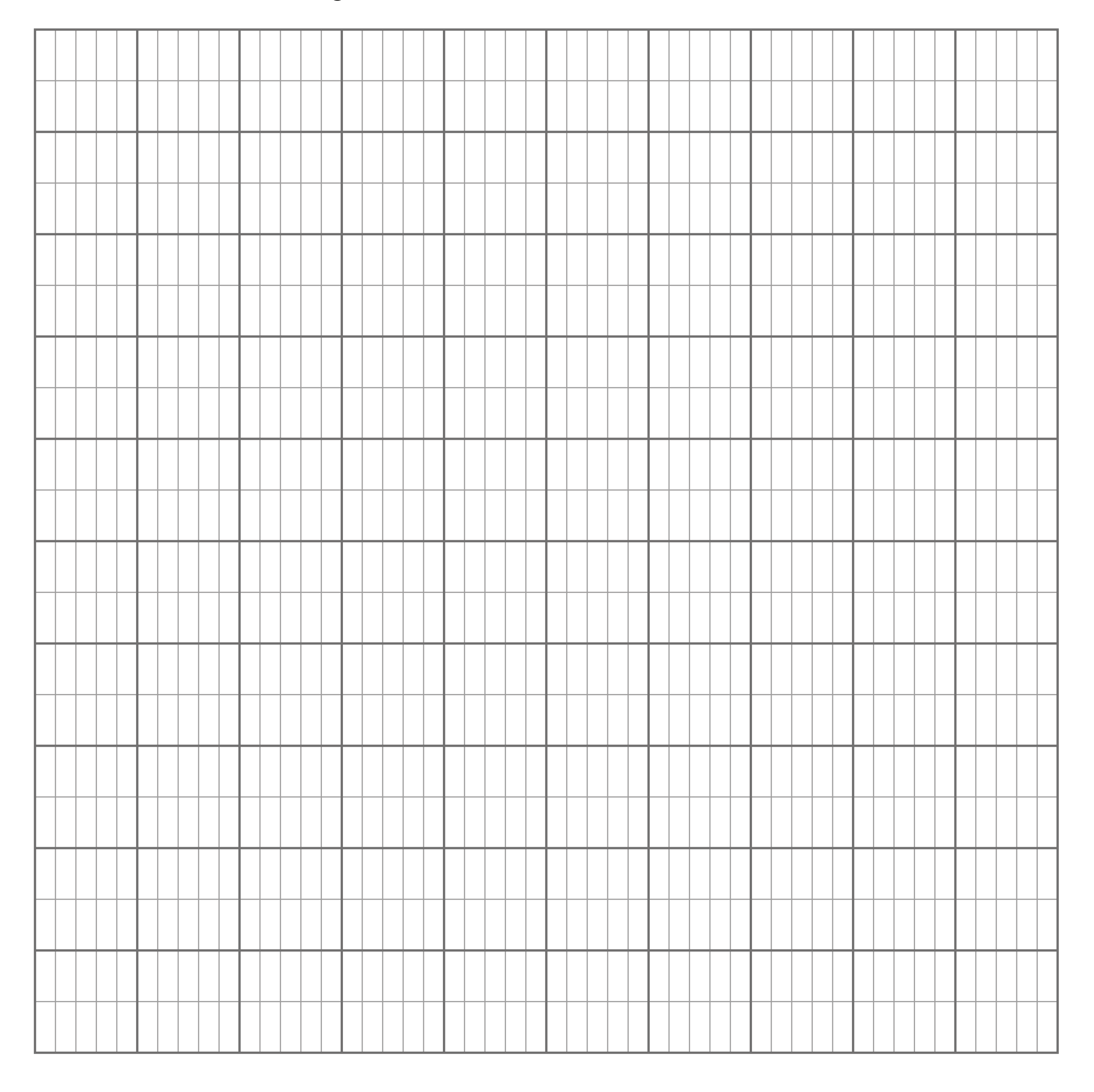
Instructions: Use the spinners in the Teacher Edition or photocopy a version for use.



Unit 1, Lesson 2
Exploring Decimals to the Thousandths Place

Large Thousandths Grid

Instructions: Create a large version of the Thousandths Grid.



Unit 1, Lesson 6
Rounding Decimals

Rounding Rule Poster

Instructions: Create a large version of the Rounding Rule Poster.

Circle the digit, look next door.
5 or higher? Add one more.
4 or less? Let it rest.
(The numbers to the right become zeroes.)

Unit 1, Lesson 7
Estimating Decimal Sums

Benchmark Decimal Numbers Chart

Instructions: Create a large version of the Decimal Numbers Chart.

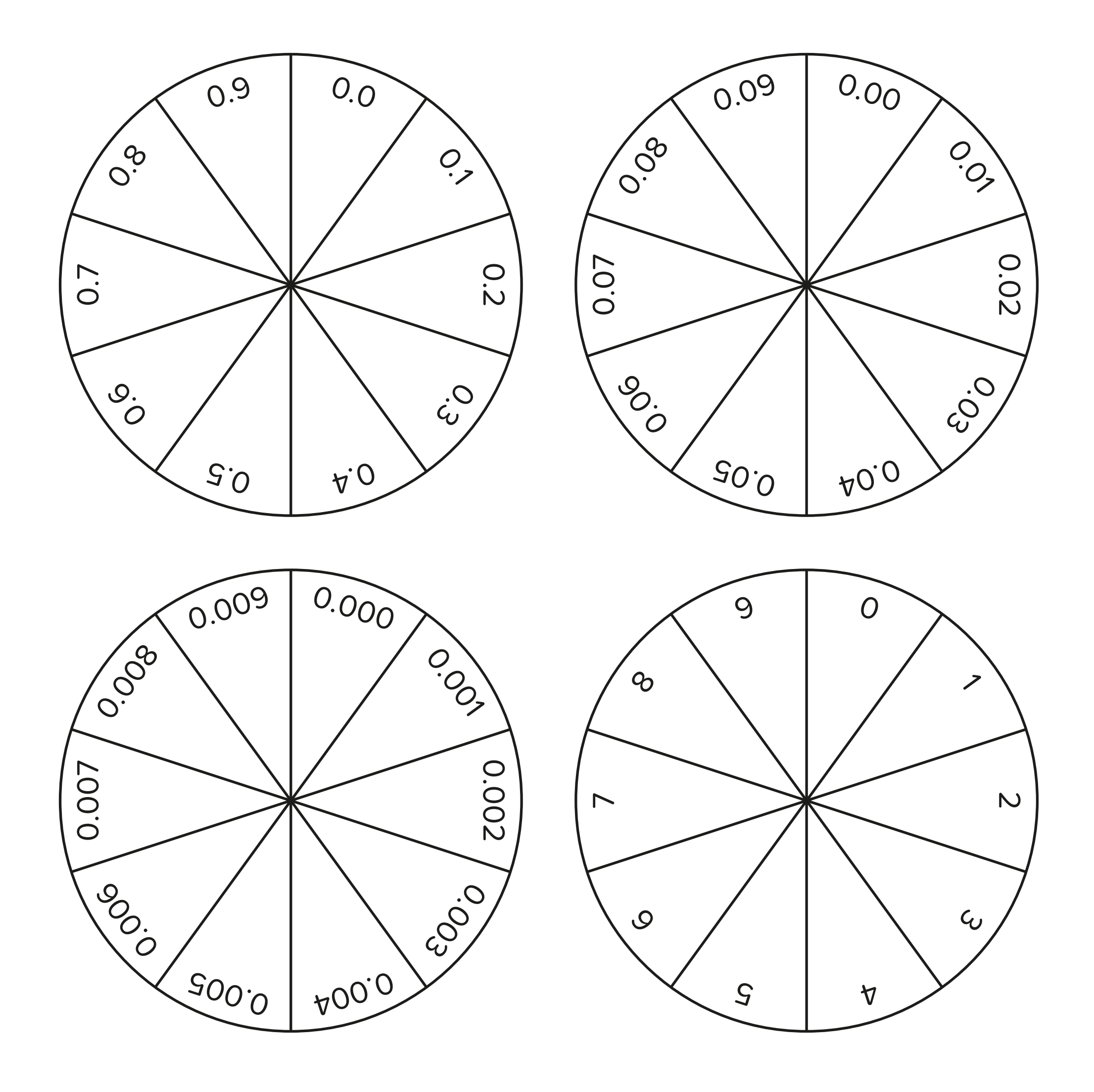
Rounding Strategies:

- *Front-End Estimation* (2 + 3 = 5)
- *Benchmark Numbers* (2 and less than half + 3 and more than half = 6)
- *Round to Ones* (2 + 4 = 6)
- *Round to Tenths* (2.4 + 3.8 = 6.2)
- *Round to Hundredths* (2.36 + 3.78 = 6.14)
- *Separate Wholes and Parts* (2 + 3 = 5, 0.361 is less than half and 0.783 is in between half and a whole, so the parts are close to another whole)

Unit 1, Lesson 9
Thinking Like a Mathematician

Decimal Spinners

Instructions: Photocopy one set of spinners for each set of partners.



Unit 1, Lesson 9
Thinking Like a Mathematician

Thinking Like a Mathematician

Instructions: Create a large version of the Thinking Like a Mathematician Anchor Chart.

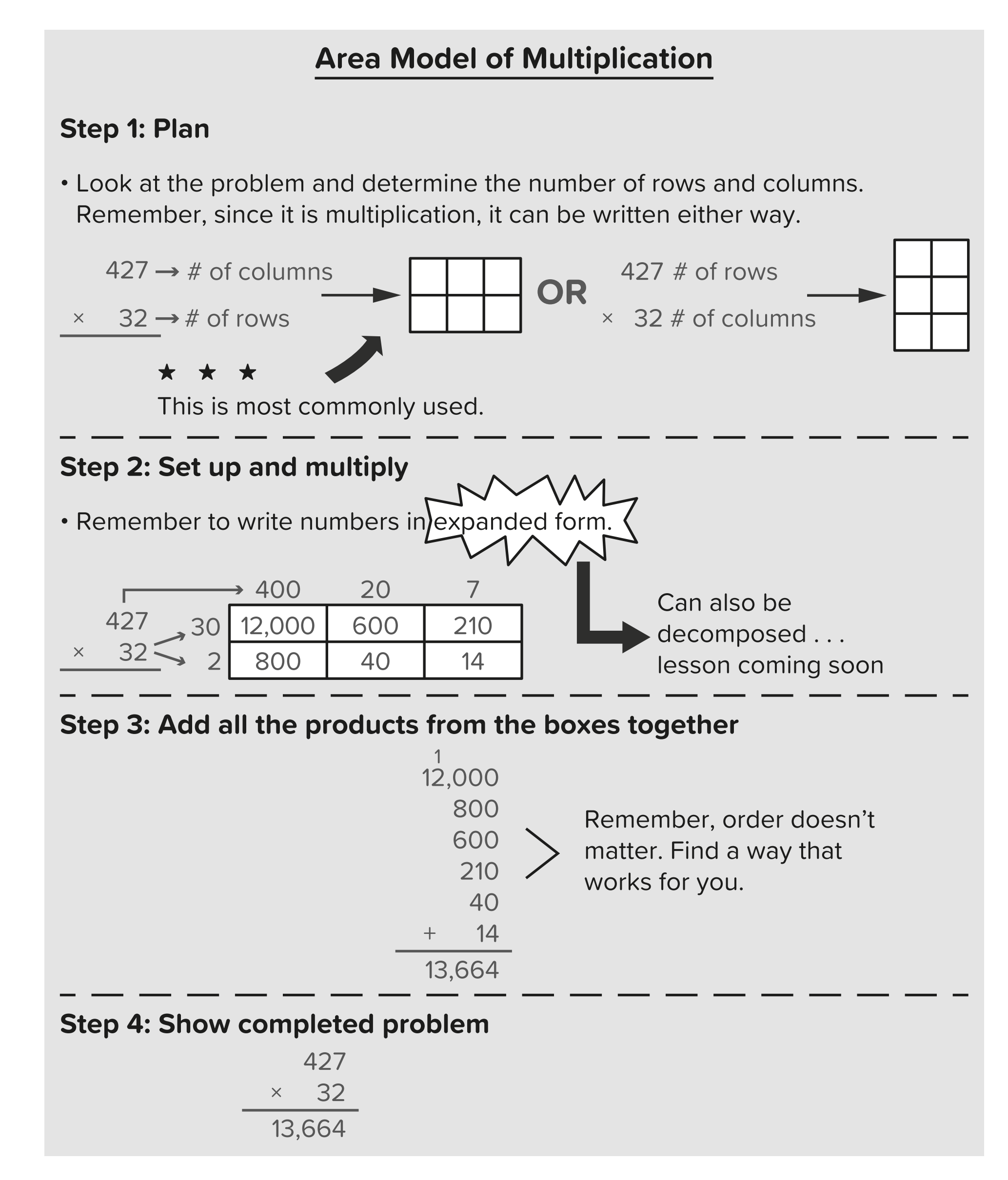
Think Like a Mathematician

Good Mathematicians . . .	
Persevere	I can make sense of problems and keep trying.
Represent	I can show what the problem is asking in pictures, numbers, and words.
Explain	I can explain my thinking and work and compare my strategy with others.
Model	I can apply what I know about math in different problems.
Use Tools	I can choose appropriate tools and use them effectively to solve problems.
Are Accurate	I work carefully and check my work to make sure it is accurate and precise.
Use Structure	I can find patterns and use what I know to solve new problems.
Notice Patterns	I can use what I notice to explain rules and shortcuts when solving problems.

Unit 3, Lesson 2
Using the Area Model to Multiply

Area Model of Multiplication Anchor Chart

Instructions: Create a large version of the Area Model of Multiplication Anchor Chart.



Unit 3, Lesson 4
Using the Partial Products Model to Multiply

Digital Cards

Instructions: Photocopy and cut apart one set of cards for each set of partners.

0	1	2
3	4	5
6	7	8
9		

Unit 3, Lesson 4

Using the Partial Products Model to Multiply

Partial Products Anchor Chart

Instructions: Create a large version of the Partial Products Anchor Chart.

Partial Product Strategy



First think how many products you will have based on the factors.

1. Determine the value of each digit.
2. Write # sentences.
3. Find partial products.
4. Add to solve.

---

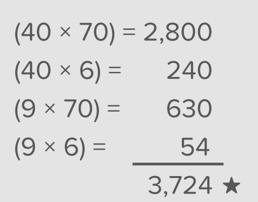
489 × 7 = ?

(7 × 400) =	2,800
(7 × 80) =	560
(7 × 9) =	+ 63
	3,423 ★

Be sure to line up correctly by place value before adding.

---

76 × 49 = ?



Does the order matter?

(40 × 70) =	2,800
(40 × 6) =	240
(9 × 70) =	630
(9 × 6) =	54
	3,724 ★

(9 × 6) =	54
(9 × 70) =	630
(40 × 6) =	240
(40 × 70) =	2,800
	?

Unit 4, Lesson 1
Understanding Division

Division Scenario Blackline Masters

Instructions: Photocopy one set (A and B) for each set of partners.

1. Tamer is studying to finish his degree. He needs to read a total of 72 pages for all of his classes to finish. He has 4 weeks to finish. How many pages does he need to read each week? Model: Equation: Number of Groups or Number in Each Group	2. Sanaa is a doctor. She needs to make appointments with 56 patients. If she is able to meet with 7 patients a day, how many days will it take her to meet with all 56? Model: Equation: Number of Groups or Number in Each Group
3. A bakery is baking desserts for a graduation party. They need to make 305 desserts. If they have 5 days to make desserts, how many desserts do they need to make each day? Model: Equation: Number of Groups or Number in Each Group	4. Yaseen is a teacher. He needs to grade 42 papers from his students. He can grade 6 papers in an hour. How many hours will it take him to grade all of the papers? Model: Equation: Number of Groups or Number in Each Group
5. Zeinab is a librarian. She has 842 books to put on the shelves. Each shelf can hold 45 books. How many shelves does she need? Model: Equation: Number of Groups or Number in Each Group	6. Fady brought some treats to share with the class. There are 50 treats and 24 people in the class. How many treats will each student get? Model: Equation: Number of Groups or Number in Each Group

Unit 4, Lesson 1
Understanding Division

Division Scenario Blackline Masters *continued*

Instructions: Photocopy one set (A and B) for each set of partners.

1. Osman is a famous wrestler. He has wrestled against 60 opponents over the past 6 months. Each month he wrestled against the same number of opponents. How many opponents did he wrestle each month? Model: Equation: Number of Groups or Number in Each Group	2. Sanaa is a doctor. She needs to make appointments with 56 patients. She has 7 days to meet with patients. How many patients does she need to meet with each day? Model: Equation: Number of Groups or Number in Each Group
3. A bakery is baking desserts for a graduation party. They need to make 305 desserts. They can make 5 desserts every hour. How many hours will it take to make 305 desserts? Model: Equation: Number of Groups or Number in Each Group	4. Moustafa wants to sell his paintings at a festival. He has 74 paintings to sell. If the festival is 3 days long, how many paintings does he need to sell each day to sell all 74? Model: Equation: Number of Groups or Number in Each Group
5. Zeinab is a librarian. She has 842 books to put on the shelves. There are 45 shelves in the library. How many books can she fit on each shelf? Model: Equation: Number of Groups or Number in Each Group	6. Mariam is reading a book for class that is 502 pages long. She can read 60 pages in a day. How many days will it take her to finish the book? Model: Equation: Number of Groups or Number in Each Group

Unit 4, Lesson 4
Estimating Quotients

Winner Takes All Cards Blackline Master

Instructions: Photocopy and cut apart one set of cards for each student.

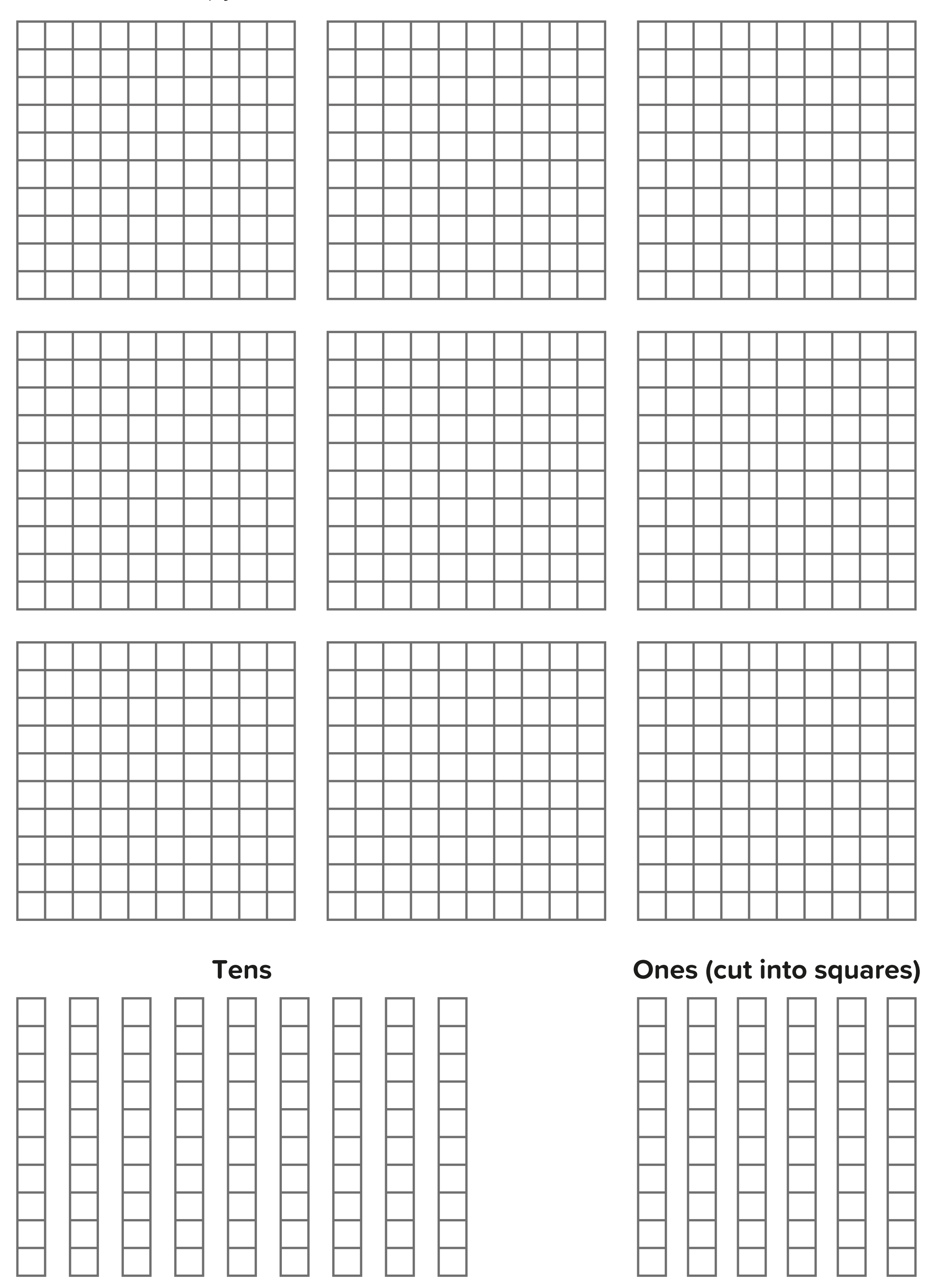
Winner Takes All Cards

1. 282 ÷ 32	2. 128 ÷ 29
3. 1,509 ÷ 67	4. 1,234 ÷ 56
5. 2,375 ÷ 27	6. 4,378 ÷ 18
7. 7,847 ÷ 92	8. 5,981 ÷ 72
9. 8,872 ÷ 43	10. 4,370 ÷ 12
11. 9,624 ÷ 48	12. 4,249 ÷ 79

Unit 5, Lesson 2
Multiplying Decimals by Whole Numbers

Base 10 Manipulatives Blackline Master

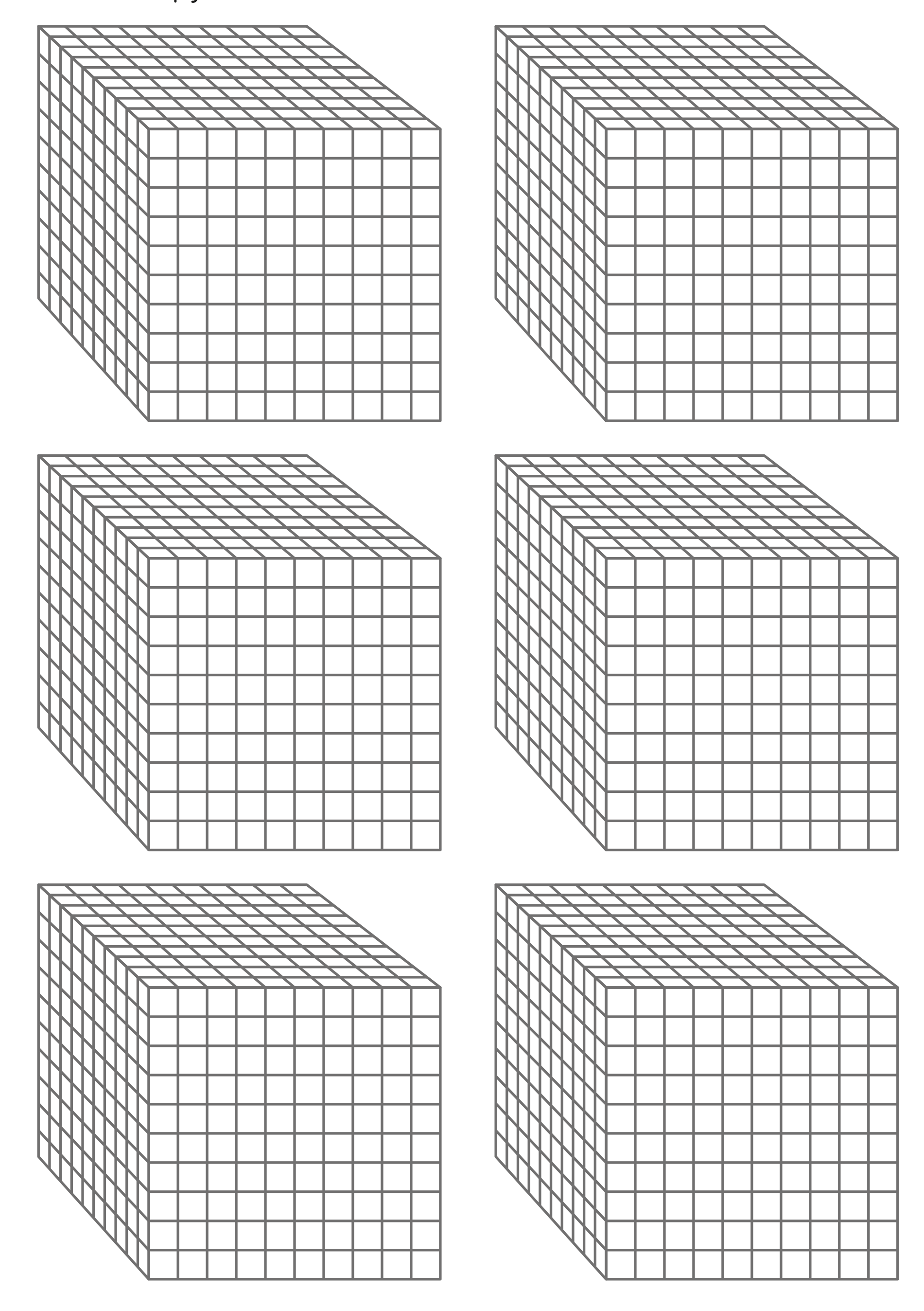
Instructions: Photocopy one set for each student.



Unit 5, Lesson 2
Multiplying Decimals by Whole Numbers

Base 10 Manipulatives Blackline Master *continued*

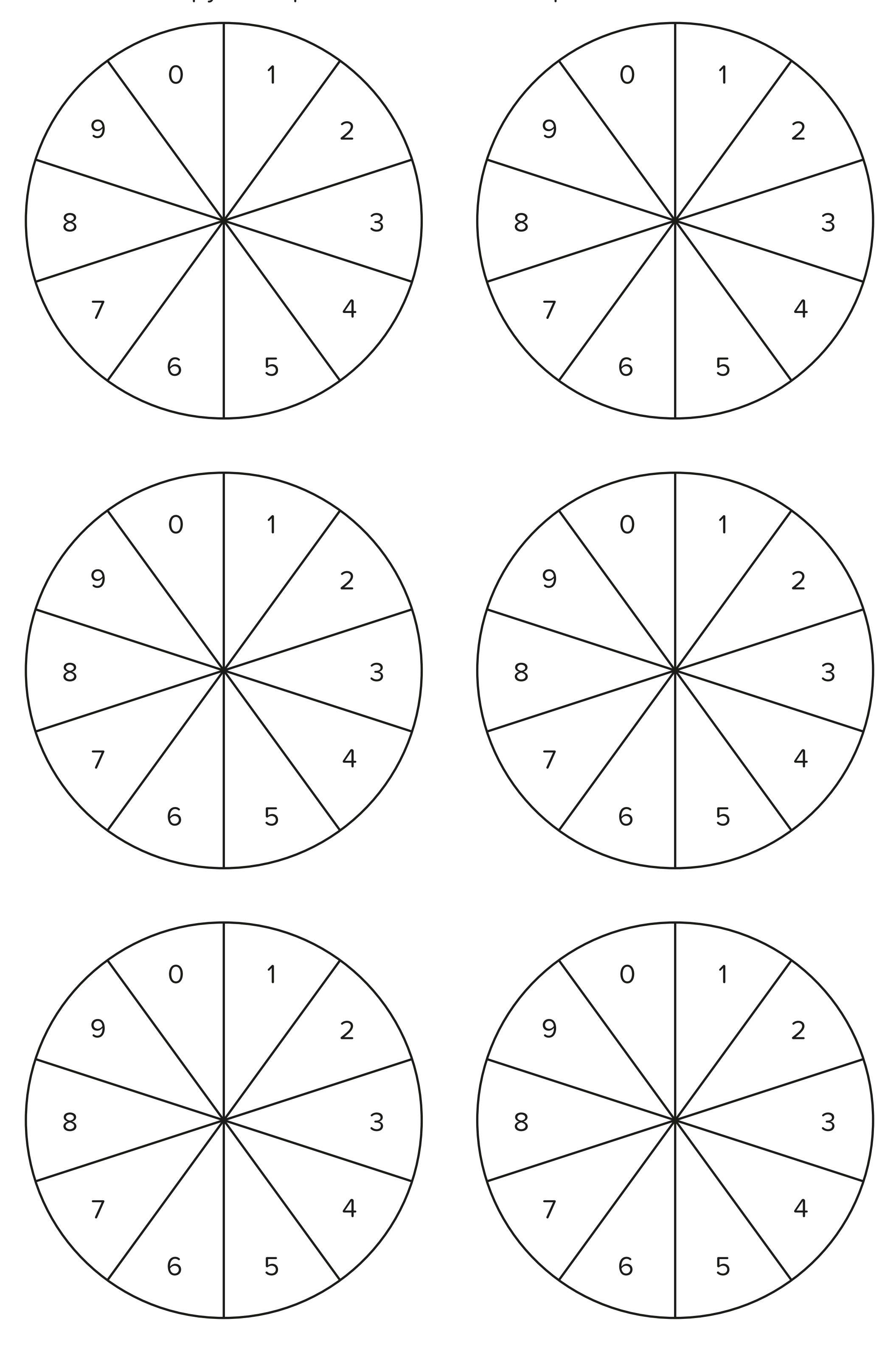
Instructions: Photocopy one set for each student.



Unit 5, Lesson 2
Multiplying Decimals by Whole Numbers

Spinners

Instructions: Photocopy one spinner for each set of partners.





A

acute
An angle measuring less than 90°.

addend
Any number being added. In the equation $6 + 8 = 14$, 6 and 8 are both addends, 14 is the sum.

algorithm
A step-by-step method for computing.

angle
Two rays that share an endpoint.

area
The measure, in square units, of the inside of a plane figure.

area model
A model of multiplication that shows each place value product.

Associative Property of Multiplication
States that changing the grouping of three or more factors does not change the product.

attribute
A characteristic or property of an object, such as color, shape, size, and so on.

B

base
Any side of a plane figure. Usually thought of as a side where the figure "sits."

benchmark
A known size or amount that can be used as a reference to help understand a different size or amount. Benchmarks can be helpful in estimation and in checking the reasonableness of answers.

benchmark fractions
Fractions that are commonly used for estimation. Benchmark fractions are useful when comparing and ordering. One-half, one-third, one-fourth, three-fourths, and two-thirds are all benchmark fractions.

brackets
Symbols used in pairs to group things together.



C

capacity
The amount of liquid a container can hold.

circle graph
A type of graph in which a circle is divided into sectors that each represent a proportion of the whole.

Glossary

circular degrees
A circle is divided into 360 equal degrees.

common factor
Any factor that is shared by two or more numbers. Six is a common factor of both 12 and 24.

common multiple
Any multiple that is shared by two or more numbers. Six is a common multiple of both 2 and 3.

Commutative Property of Addition
States that changing the order of the addends does not change the sum.

Commutative Property of Multiplication
States that changing the order of the factors does not change the product.

compatible numbers
Numbers that are easy to compute mentally and are close in value to the actual numbers. Compatible numbers can be used when estimating.

compose
To put together smaller numbers to make larger numbers.

composite
A positive number that is not prime.

compound shape
Any shape that is made up of two or more geometric shapes.

cone
A solid object that has a circular base joined to a point by a curved side.

congruent
Having exactly the same size and shape.

coordinate
A set of values that show an exact position.

coordinate plane
A two-dimensional system in which a location is described by its distances from two perpendicular reference lines (axes). Also called a coordinate grid.

cube
A box-shaped solid object that has six identical square faces.

cubic units
A number, multiplied by itself and then multiplied again by itself.

cylinder
A solid object with two identical flat ends that are circular or elliptical and one curved side.



D

decompose
To separate a number into two or more parts.

denominator
The quantity below the line in a fraction. It tells how many equal parts are in the whole.

difference
The amount that remains after one quantity is subtracted from another. The answer in a subtraction problem.

digit
Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9. (Also known as Base 10 numerals.)

dimension
A measurement of length in one direction.

Distributive Property of Multiplication
States that whether the numbers in parentheses are added before or after multiplication, the results are the same.

dividend
A number that is divided by another number. Fifty-six is the dividend in $56 \div 8 = 7$.

division
Splitting into equal parts or groups also known as fair sharing.

divisor
The number by which another number is divided. Eight is the divisor in $56 \div 8 = 7$.



edge
A line segment on the boundary joining one vertex to another.

equation
A mathematical sentence with an equal sign. The amount on one side of the equal sign has the same value as the amount on the other side. $4 + 3 = 7$

equilateral
Having all sides of equal length.

equivalent
Having the same value.

estimate
To find a number close to an exact amount; an estimate tells about how much or about how many.

expanded form
A way to write numbers that shows the place value of each digit. $263 = 200 + 60 + 3$

exponent
A symbol written above and to the right of a mathematical expression to indicate the operation of raising to a power.

expression
A mathematical phrase without an equal sign. $n + 4$

Glossary



face
Any of the individual flat surfaces of a solid object.

factor
Numbers we can multiply together to get another number.

factor pair
Two numbers that multiply together to reach a certain product.

factor tree
A diagram that shows all the factors of a number, with the number appearing at the top of the "tree" and factors of that number appearing in "branches" until each branch ends in prime number.

finite
Not infinite. Has an end.

formula
A rule that is written as an equation. $A = l \times w$

fraction
A way to describe a part of a whole or a part of a group by using equal parts.

frequency
The number of times an event or a value occurs.



greatest common factor (GCF)
The greatest number that is a factor of two (or more) other numbers.



hierarchy
A way of ranking and organizing things or people.

Hundredths
In the decimal numeration system, Hundredths is the name of the next place to the right of Tenths.



Identity Property of Multiplication
States that the product of any number and 1 is that number: $n \times 1 = n$.

improper fraction
A fraction in which the numerator is larger than or equal to the denominator.

infinite
Without an end. Not finite.

input
The known variable you feed into an expression.

intersect
A single point where two lines meet or cross each other.

intersecting
Two or more lines cross each other in a plane, sharing a common point.

inverse operation
Opposite operations. They are the operation that reverses the effect of another operation.

irregular polygon
A polygon that does not have all sides equal and all angles equal.

isosceles
A triangle having two sides equal in length.



L

layers
Horizontal segments of a three-dimensional figure; used for calculating the volume of the figure by decomposing it.

least common multiple (LCM)
The smallest positive number that is a multiple of two or more numbers.

like denominators
Denominators in two or more fractions that are the same.

line graph
A type of chart used to show information that changes over time.



M

midpoint strategy
A method in which students use the midpoint of a number line to help visualize rounding numbers.

Milliard
One thousand million.

minuend
A number from which another is to be subtracted.

mixed number
A number that has a whole number and a fraction.

multiple
A product of a given whole number and any other whole number. Twelve is a multiple of 3 and 4 because $3 \times 4 = 12$.

multiples
Numbers created by multiplying two factors.

multiplication
The method of finding the product of two or more numbers; repeated addition.

multiplicative comparison
A way to compare quantities using multiplication, as in “This tree is three times shorter than that tree.”



nets
Patterns that can be cut and folded to make a model of a solid shape.

numerator
The number written above the line in a fraction. It tells how many equal parts are described in the fraction.

numerical pattern
A list of numbers that follow a certain sequence or pattern.



obtuse
An angle measuring greater than 90°.

order of operations
A set of rules that tells the order in which to compute.

1. For operations within parentheses
   a. multiply or divide from left to right
   b. add or subtract from left to right
2. For operations within brackets
   a. multiply or divide from left to right
   b. add or subtract from left to right
3. For operations outside parentheses
   a. multiply or divide from left to right
   b. add or subtract from left to right

ordered pair
A pair of numbers used to locate a point on a coordinate plane; the pair is written in the form (x-coordinate, y-coordinate); x-coordinate is the perpendicular distance of the point from the y-axis; the y-coordinate is the perpendicular distance of the point from the x-axis.

origin
In a coordinate plane, the point at the intersection of the x- and y-axes; the point (0, 0).

output
What comes out of the function; the solution.

overestimate
An estimate that is greater than the actual answer to a problem.



parallel
Always the same distance apart and never touching.

parentheses
Grouping symbols for operations. When simplifying an expression, the operations within the parentheses are performed first.

partial products
Any of the multiplication results we get leading up to an overall multiplication result.

partial products model
A model that breaks numbers down into their factors or place values to make multiplication easier.

partial quotients model
A method of dividing in which multiples of the divisor are subtracted from the dividend, and then the partial quotients are added together.

pattern
A repeating or growing sequence or design.

percentage
A number or ratio expressed as a fraction of 100.

perimeter
The distance around the outside of a figure.

perpendicular
Two lines intersecting each other at 90° or a right angle.

pie chart
A type of graph in which a circle is divided into sectors that each represent a proportion of the whole.

place value
The value of the place of a digit in a number.

powers of ten
A set of mathematical notations that allow you to express any number as a product of multiples of 10.

prime
A number greater than 1, with only two factors.

prime factorization
Finding which prime numbers multiply together to make the original number.

prime number
A whole number greater than 1 that has exactly two different factors, 1 and itself.

product
The answer to a multiplication problem. In $6 \times 7 = 42$, 42 is the product, or answer.



quotient
The answer to a division problem.



ray
A part of a line that has one endpoint and goes on forever in one direction.

reasonable
Makes sense according to the numbers and operation used.

rectangular prism
A solid object that has six faces that are rectangles.

regroup
To rearrange numbers into groups of 10 when performing mathematical operations.

regrouping
The process of making groups of tens when adding or subtracting two-digit numbers (or more).

reliable
To be consistent in results.

remainder
The amount left over when one number is divided by another.

repeating decimal
A decimal in which after a certain point a particular digit or sequence of digits repeats itself indefinitely.

right angle
An angle that measures exactly 90°.

round
A way to change a number to a shorter or simpler number that is very close to the original number.

rule
Something that happens every time (for example: 2, 5, 8, 11 . . . the rule is +3).



sample size
A selection taken from a larger group (the "population") that provides information about the larger group.

scalene
A triangle having three sides unequal in length.

sequence
A set of numbers arranged in a special order or pattern.

simplest form
When a fraction is expressed with the fewest possible pieces, it is in simplest form (also known as lowest terms and reduced).

simplify
To express a fraction in simplest form.

slices
Vertical segments of a three-dimensional figure; used for calculating the volume of the figure by decomposing it.

sphere
A three-dimensional object shaped like a ball.

square pyramid
A three-dimensional geometric shape that has a square base and four triangular bases that are joined at a vertex.

squared
A number multiplied by itself.

standard algorithm for multiplication
Strategy for multiplying by using partial products or multiplying in parts.

standard form
A common or usual way of writing a number using digits. 12,376 is in standard form.

subtrahend
A number to be subtracted from another.

sum
The answer to an addition problem.

survey size
The measure of the number of individual surveys used in an experiment.

symmetry
When two or more parts are identical after a flip, slide, or turn.



Tenths
In the decimal numeration, Tenths is the name of the place to the right of the decimal point.

terminating decimal
A decimal number that has digits that end.

Thousandths
The value of a digit that is the fourth position from the right when describing whole number place value.

Three Reads Strategy
A problem-solving strategy in which a story problem is read three times—once to understand what is happening in the problem, a second time to think about the numbers in the problem and what they might mean, and a third time to think about what question the problem could be asking.

tiling
Overlay of individual tiles that cover the plane without gaps or overlaps; strategy for calculating area.



underestimate
An estimate that is less than the actual answer to a problem.

unit fraction
A fraction that has 1 as its numerator. A unit fraction names 1 equal part of a whole.

unit squares
A unit square is a square whose sides have length 1.

unknown
Part of an expression or equation that has to be found; a variable that can be represented in a problem by a letter.

unlike denominators
Bottom numbers of two or more fractions that are not equal.



V

value
How much a digit is worth depending on where it is in a number; the result of a calculation.

variable
A letter or symbol that represents a number. For example, in $5 \times b = 10$, b.

vertex
The point at which two line segments, lines, or rays meet to form an angle.

vertices
The point where the edges of a solid figure meet.



X

***x*-axis**
The horizontal axis on the coordinate plane.

***x*-coordinate**
The first number in an ordered pair; tells whether to move right or left along the *x*-axis of the coordinate plane.



Y

***y*-axis**
The vertical axis on the coordinate plane.

***y*-coordinate**
The second number in an ordered pair; tells whether to move up or down along the *y*-axis of the coordinate plane.



4 of 20 stripes
are yellow
= 20% of wheel
1
2
3
4
2
Dancer #3
(2 , 3)
Dancer #2
(2 , 6)
Primary 5
Teacher Edition
Math Term 1
2022–2023
Discovery
EDUCATION
الإدارة المركزية لتطوير المناهج
CACD
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